COX CASTLE NICHOLSON

Cox, Castle & Nicholson LLP
2049 Century Park East, 28th Floor
Los Angeles, California 90067-3284
P 310.277.4222 F 310.277.7889

Charles J. Moore
310.284.2286
cmoore@coxcastle.com

File No. 46022

February 22, 2008

Board of Supervisors
c/o Executive Officer
County of Los Angeles
Room 383
500 West Temple Street
Los Angeles, California 90012

Re: **Agenda Item 17; February 26 Board Meeting**
Appeal of Amendment to Approved Vesting Tentative Tract Map No. 48086-(5); Spring Canyon Project

Dear Supervisors:

We represent Pardee Homes, the owner and developer of the Spring Canyon project, located northerly of the Antelope Valley Freeway in the Santa Clarita Valley. The Board of Supervisors approved land use entitlements for Spring Canyon in 2004. The approved entitlements include amendments to the General Plan and Santa Clarita Valley Area Plan, a zone change, vesting tentative tract map, conditional use permit, oak tree permit, and final environmental impact report ("EIR").

During final engineering for the project, the local elementary school district and County agencies requested technical changes to the approved tentative tract map. The requested technical changes conform substantially to the project footprint and design approved by the Board in 2004.

The Department of Regional Planning employs a practical and important amendment procedure to make minor changes to approved tentative maps without need for reopening the project.

The Santa Clarita Organization for Planning and the Environment (SCOPE) is now using the developer's limited request to amend its approved subdivision to attempt to revisit water supply issues that are wholly unrelated to the requested technical changes.

We believe the Board is not deciding whether water should be provided to Spring Canyon by this amendment. Indeed, the Newhall County Water District ("NCWD") already approved a water service agreement for the project.

Spring Canyon is an Approved Project

The Board approved the Spring Canyon project in 2004, after a public hearing at the Regional Planning Commission and three further public hearings at the Board of Supervisors. The Board also certified a final EIR to support the project approval.

The approved project includes 542 homes, a fire station site, a sheriff substation site, two parks, open space and an off-site elementary school site.

The certified final EIR includes a water supply assessment approved by the NCWD as required by current water supply laws.

Technical Engineering Changes to the Approved Subdivision Will Improve the Project

After the project entitlements for Spring Canyon were approved, Pardee Homes purchased the property and began final engineering of the project.

At this late stage, the Sulphur Springs School District asked that the off-site elementary school be moved within the project boundaries. During the public hearings for Spring Canyon, there was always a possibility that the school would be located within the project. As such, the certified final EIR already contemplates and analyzes an alternative project that locates the school within the project.

Other minor engineering changes were also requested by County agencies, some to accommodate the relocated school and others to improve the subdivision's design.

The Hearing Officer Approved the Requested Engineering Changes

The technical changes to the subdivision map were presented to the Hearing Officer in a request to amend the approved tentative tract map in August, 2007. The Hearing Officer approved the amendment. SCOPE appealed the Hearing Officer's decision, based upon water supply issues that are not affected by the technical changes requested by the amendment.

The Regional Planning Commission Upheld the Hearing Officer's Approval of the Requested Engineering Changes

The Regional Planning Commission denied SCOPE's appeal of the Hearing Officer's approval of the requested amendments last month. SCOPE has appealed the Regional Planning Commission's decision to the Board of Supervisors, based again on water supply issues that are unrelated to the technical engineering changes proposed by the amendment. The Board is not deciding whether water should be provided to Spring Canyon.

The Water District Has Already Agreed to Provide Water to Spring Canyon, and the County's Amendment Proceeding Cannot Affect That Approval

Since the approval of the project in 2004, Pardee Homes and its engineers have continued to work closely with the NCWD to design and finance the water infrastructure needed for NCWD to deliver water to the project.

On October 12, 2006, the NCWD Board of Directors approved a water service agreement for the project. Prior to the completion of construction of the project and water delivery facilities, there is no more definite assurance of water availability that a project can obtain than a water service agreement.

To support its approval of the water service agreement, NCWD prepared and adopted its own 106-page addendum to the certified final EIR to update and further analyze water supply for the project.

The Board is not considering whether to provide water for Spring Canyon. NCWD's water service agreement is final and cannot be affected by this limited amendment proceeding.

The Requested Amendment Does Not Change the Water Supply Analysis for the Approved Project

This amendment is desired only to improve upon an approved project to meet the needs of a school district and County agencies. The requested technical amendments do not change the project's impacts to water supply as analyzed previously in the certified final EIR and NCWD's adopted addendum.

Indeed, this amendment actually reduces water demand for the project. The number of homes are reduced from 542 to 499, a difference of 43 homes. The school site, although off-site, was always included as part of the approved project, and its demand for water is analyzed in NCWD's water supply assessment and in the final EIR.

In any event, current information indicates that sufficient water supplies are available to serve Spring Canyon and other demand forecasted through the year 2030 in NCWD's 2005 urban water management plan. Please see the attached analyses and supporting technical reports.

The County's Amendment Procedure is Practical and Essential

Most large residential projects require some technical modifications during final engineering. The design process continues long after the public hearings for a project have concluded, and final engineering typically uncovers more precise on-the-ground information necessitating changes to the tentative map.

The Department of Regional Planning for many years has employed an informal administrative process to allow minor technical amendments to approved tentative maps. The amendment process has been used successfully for many years, and is essential to the continued delivery of service to the building industry. As a policy matter, if every amendment invited the decision-maker to reconsider the conclusions from a previously-approved EIR, there would be no finality to the approval process.

The County's Amendment Procedure is Limited

The only current issues are whether the school site should be moved within the project boundaries and whether other technical changes requested by County agencies should be applied to the approved tentative tract map. The Spring Canyon development is an approved project and cannot be reconsidered by the Board of Supervisors.

The Subdivision Map Act Accommodates the Need to Make Technical Changes to Tentative Maps During Final Engineering

The Subdivision Map Act does not require a final map to be identical to an approved tentative map. It requires only that final maps substantially conform to the approved tentative map. (Government Code §66474.1.) The legislature thereby recognized implicitly that limited engineering changes may become necessary between tentative map approval and the final map, and do not require re-opening of the public hearing and approval process.

The subdivision process insures that the final map substantially conforms to the approved tentative map. First, when the Department of Regional Planning considers requests to amend a tentative map, planning staff considers whether the changes are sufficiently minor to be approved through the amendment process. If the requested changes are not minor, staff will require the developer to file an application for a revised tentative map, and this will in turn require the same due process and public hearing requirements as an application for a new tentative map.

Second, before approving a final map, the Board of Supervisors must make a finding that the final map substantially conforms to the approved tentative map. (Government Code §66474.1.)

The Regional Planning Commission and the Board of Supervisors Can Reject the Appeal

There is no authority to appeal an amendment to an approved subdivision map. The County Code authorizes interested persons to appeal decisions of the Hearing Officer to the Regional Planning Commission and ultimately to the Board of Supervisors, but only when he or she is functioning as the advisory agency with respect to a tentative map. (County Code §21.56.010.)

The County Code limits advisory agency duties to those associated with the submission, review, or approval or disapproval of maps. (County Code §21.08.020.) Submission, review, approval or disapproval of maps includes only the initial decision to approve the entire subdivision map; it does not include limited engineering amendments to already approved maps.

Moreover, the County Code does not prescribe a process to amend an approved tentative map. There is no statutory requirement that amendments be approved by the Hearing Officer or the Regional Planning Commission, and public notice and hearings are not required.

The amendment process is guided only by a staff interpretation memorandum. (See County of Los Angeles Department of Regional Planning, Subdivisions and Zoning Ordinances Interpretations and Procedures Manual: First Edition, June 2007, Amendments and Revisions to Approved Tentative Maps: Reference Section 21.40.) Staff's interpretation memorandum does not prescribe a public process for amendments. Indeed, amendments were approved by the Director or his or her representative for many years.

Furthermore, the initial approval of a tentative map may impact surrounding properties and therefore requires the County to provide public notice and an opportunity for a hearing. (*Horn v. County of Ventura*, 24 Cal. 3d 605, 612 (1979).) Where public notice and hearings are required, it is equally appropriate that interested persons be allowed to appeal those decision to the legislative body. That is not the case with an amendment, where public notice and public hearings are not required or provided.

There is a Strong Presumption Against Additional Environmental Review Once an EIR Has Been Prepared for a Project

NCWD approved a water supply assessment for Spring Canyon in 2002 as part of the County's environmental review of the project. The approved water supply assessment was included in the certified final EIR. The water supply assessment and certified final EIR were not challenged in court.

To give a degree of finality to the environmental review process, CEQA includes a strong presumption against requiring any further environmental review once an EIR has been prepared for a project. (Public Resources Code Section 21166; CEQA Guidelines Section 15162.) In addition, a certified EIR that has not been timely challenged in a lawsuit is conclusively presumed valid. (*Laurel Heights Improvement Ass'n v. Regents of the Univ. of Cal.* (1993) 6 Cal.4th 1112, 1130.)

Post-approval project changes that do not increase the project's environmental impacts do not require additional environmental review. (*Benton v. Board of Supervisors* (1991) 226 Cal. App. 3d 1467.) Furthermore, environmental review is limited to a comparison of the impacts of the amended project to the original project. (*Id.*)

Courts Have Upheld Local Agency Determinations That Additional Environmental Review is Not Needed for Changes to an Approved Project

In situations such as this one where a developer proposes minor project changes following a prior approval, local agencies have decided against requiring further environmental review, and the courts have upheld those decisions. (*See Benton*, 226 Cal. App. 3d at 1473) (SEIR not required for project changes, which involved relocating a winery on an enlarged site, reducing the size of the winery buildings, adding underground storage caves and altered access routes, and building the winery buildings one mile to the west and closer to existing residences); *Bowman*, 185 Cal. App. 3d at 1079-1080 (change in traffic design from one street to another not sufficient to require SEIR).)

There is substantial evidence to suggest that further analysis of water supply is unwarranted here. The requested changes to the subdivision are technical in nature and reduce the water demand for the project.

In conclusion, the Spring Canyon development is an approved project and this limited amendment request should not be used by SCOPE to reconsider issues decided years ago, which are wholly unrelated to this amendment request.

Sincerely,

CJ Moore

Charles J. Moore

Enclosure

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cc: Dean Efstathiou
Bruce McClendon
Jon Sanabria
Frank Meneses
Susan Tae
Ramon Cordova
Richard Weiss, Esq.

February 21, 2008

Summary of Updated State Water Project Water Supply Conditions

Introduction

This memorandum provides a summary of the updated water supply conditions relative to Castaic Lake Water Agency's (CLWA) State Water Project (SWP) supplies as described in CLWA's 2005 Urban Water Management Plan (2005 UWMP). The updated conditions included herein focus on the information provided in CLWA's February 5, 2008 letter to the Los Angeles County Department of Regional Planning which is included as Attachment A to this memorandum (CLWA Letter), as well as additional updated information subsequently provided by CLWA. The aforementioned letter and information provide an update of the water supply conditions resulting from the release of the Draft SWP Delivery Reliability Report 2007 (DWR 2007).[1]

The purpose of this memorandum is to provide additional detail and background information related to the CLWA Letter and the associated updated SWP water supply conditions, and to include the supplementary information subsequently provided by CLWA.

CLWA 2005 Urban Water Management Plan

Table 1 below, excerpted from CLWA's 2005 UWMP,[2] summarizes the projected average/normal year supplies and demands as shown in the 2005 UWMP, and includes the associated assumptions and notes, as described in the 2005 UWMP. It is noted that subsequent to the completion of the 2005 UWMP, the Rosedale-Rio Bravo Water Storage District Water Banking and Exchange Program (identified as the Rosedale-Rio Bravo project in Table 1) was approved, an agreement finalized, and water has been banked pursuant to the agreement. In addition, since the 2005 UWMP was completed, the Water Acquisition

[1] The Draft SWP Delivery Reliability Report 2007 was released for public review on January 28, 2008 and the comment period will end on March 13, 2008.

[2] In February 2006, the California Water Impact Network and Friends of the Santa Clara River ("petitioners") filed a lawsuit challenging the adequacy of the 2005 UWMP on multiple grounds, *California Water Impact Network v. Castaic Lake Water Agency* (Los Angeles County Superior Court). Petitioners' main arguments were that the 2005 UWMP allegedly overstated the reliability of both groundwater and surface water supplies, failed to provide an adequate discussion of perchlorate contamination, failed to adequately address the reliability of the 1999 SWP Table A permanent transfer of 41,000 afy from Wheeler Ridge-Maricopa Water Storage District to CLWA, relied on a flawed model for predicting SWP deliveries, failed to address the effect of global warming and regulatory water quality controls on water deliveries from the SWP, and failed to identify the impact of private wells on the Santa Clarita River watershed. On August 3, 2007, the trial court issued a Statement of Decision ruling in favor of CLWA and its retail agencies on all issues raised by Petitioners and finding the 2005 UWMP legally adequate. On August 22, 2007, Judgment was entered in favor of CLWA and the purveyors. On October 19, 2007, the Petitioners appealed this Judgment to the 2nd District Court of Appeal. In the meantime, the 2005 UWMP must be assumed legally adequate, unless and until it is set aside by a court of competent jurisdiction. (Wat. Code § 10651; *Barthelemy v. Chino Basin Water Dist.* (1995) 38 Cal. App.4th 1607, 1609 [agency actions are presumed to comply with applicable law, until proof is presented to the contrary].) That has not occurred.

from the Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District Water Banking and Recovery Program (identified as the Buena Vista-Rosedale project in Table 1) project EIR was certified and the agreement was completed.[3] Also, the information presented in Footnote 5 and 6 of Table 1 (excerpted from the 2005 UWMP) with regard to annexations is no longer current because CLWA is deferring temporarily consideration of annexation requests.

As described in Footnote 1 of Table 1, SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 acre-feet[4] (af) by percentages of average deliveries projected to be available (71 percent in 2010 and 77 percent in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report "(May 2005).

Table 2 and Table 3 below, also excerpted from CLWA's 2005 UWMP, summarize the projected single-dry and multi-dry year supplies and demands as shown in the 2005 UWMP, and include the associated assumptions and notes, as described in the 2005 UWMP. The updates related to the Rosedale-Rio Bravo, the Buena Vista-Rosedale project, and annexations identified above for Table 1 are applicable.

[3] In November 2006, a complaint and petition for writ of mandate seeking to set aside CLWA's certification of its Environmental Impact Report (EIR) for the 2006 Water Acquisition Project with Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District Banking and Recovery Program was filed by California Water Impact Network in the Los Angeles County Superior Court. In November 2007, the trial court filed its Statement of Decision finding that in certifying the EIR and approving the project CLWA proceeded in a manner required by law, and that its actions were supported by substantial evidence. Judgment was entered in favor of CLWA in December 2007. Petitioners filed a notice of appeal of the Judgment on January 31, 2008. This appeal is pending.

[4] Of CLWA's 95,200 af annual Table A Amount, 41,000 afy was permanently transferred to CLWA in 1999 by Wheeler Ridge-Maricopa Water Storage District, a member unit of the Kern County Water Agency. CLWA's EIR prepared in connection with the 41,000 afy water transfer was challenged in *Friends of the Santa Clara River v. Castaic Lake Water Agency* (Los Angeles County Superior Court) ("*Friends*"). On appeal, the Court of Appeal held that since the 41,000 afy EIR tiered off the Monterey Agreement EIR that was later decertified, CLWA would also have to decertify its EIR as well and prepare a revised EIR. CLWA was not prevented from using any water that is part of the 41,000 afy transfer. Under the jurisdiction of the Los Angeles County Superior Court, CLWA prepared and circulated a revised Draft EIR for the transfer. CLWA approved the revised EIR in late 2004 ("2004 EIR") and lodged the EIR with the Los Angeles Superior Court. Thereafter, the case was dismissed with prejudice (permanently).

In January 2005, two new challenges to CLWA's 2004 EIR were filed in the Ventura County Superior Court by the Planning and Conservation League ("PCL") and by the California Water Impact Network ("CWIN"); these cases were consolidated and transferred to Los Angeles County Superior Court, *Planning and Conservation League v. Castaic Lake Water Agency* (Los Angeles County Superior Court,) ("*PCL Action*"). In May 2007, a final Statement of Decision was filed by the trial court in the *PCL Action*. It included a determination that the transfer is valid and cannot be terminated or unwound. The trial court did find one defect in the 2004 EIR, requiring Judgment to be entered against CLWA. The defect, however, did not relate to the environmental conclusions reached in the 2004 EIR. CLWA has been ordered to set aside its certification of the 2004 EIR, correct the defect and report back to the Court. The Writ issued by the Court as part of the Judgment specifically states that the Judgment does not call for CLWA to set aside the transfer. In July 2007, Petitioners filed a Partial Notice of Appeal and CLWA subsequently filed a Notice of Cross Appeal.

TABLE 1
Projected Average/Normal Year Supplies and Demands

Water Supply Sources	**Supply (af)**				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*67,600*	*69,500*	*71,400*	*73,300*	*73,300*
SWP Table A Supply (1)	67,600	69,500	71,400	73,300	73,300
Flexible Storage Account (CLWA) (2)	0	0	0	0	0
Flexible Storage Account (Ventura County) (2)	0	0	0	0	0
Local Supplies					
Groundwater	*46,000*	*46,000*	*46,000*	*46,000*	*46,000*
Alluvial Aquifer	35,000	35,000	35,000	35,000	35,000
Saugus Formation	11,000	11,000	11,000	11,000	11,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	115,300	117,200	119,100	121,000	121,000
Existing Banking Programs					
Semitropic Water Bank (2)	0	0	0	0	0
Total Existing Banking Programs	0	0	0	0	0
Planned Supplies					
Local Supplies					
Groundwater	*0*	*0*	*0*	*0*	*0*
Restored Wells (Saugus Formation) (2)	0	0	0	0	0
New Wells (Saugus Formation) (2)	0	0	0	0	0
Recycled water (3)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (4)	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	11,000	12,600	17,300	22,000	26,700
Planned Banking Programs					
Rosedale-Rio Bravo (2)	0	0	0	0	0
Additional Planned Banking (2)	0	0	0	0	0
Total Planned Banking Programs	0	0	0	0	0
Total Existing and Planned Supplies and Banking	126,300	129,800	136,400	143,000	147,700
Total Estimated Demand (w/o conservation) (5)	100,050	109,400	117,150	128,400	138,300
Conservation (6)	(8,600)	(9,700)	(10,700)	(11,900)	(12,900)
Total Adjusted Demand	91,450	99,700	106,450	116,500	125,400

Source: CLWA 2005; Table 6-2.

TABLE 1
Projected Average/Normal Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030

Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available (71% in 2010 and 77% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report " (May 2005).
(2) Not needed during average/normal years.
(3) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.
(4) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.
(5) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 4).
(6) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in Chapter 7.

TABLE 2
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*9,860*	*9,800*	*8,480*	*9,480*	*9,480*
SWP Table A Supply (1)	3,800	3,800	3,800	4,800	4,800
Flexible Storage Account (CLWA)	4,680	4,680	4,680	4,680	4,680
Flexible Storage Account (Ventura County) (2)	1,380	1,380	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	59,060	59,060	57,680	58,680	58,680
Existing Banking Programs					
Semitropic Water Bank (3)	17,000	0	0	0	0
Total Existing Banking Programs	17,000	0	0	0	0

TABLE 2
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Planned Supplies					
Local Supplies					
Groundwater	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*
Restored Wells (Saugus Formation)	10,000	10,000	10,000	10,000	10,000
New Wells (Saugus Formation)	0	0	10,000	10,000	10,000
Recycled water (4)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (5)	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	21,000	22,600	37,300	42,000	46,700
Planned Banking Programs					
Rosedale-Rio Bravo (6)	20,000	20,000	20,000	20,000	20,000
Additional Planned Banking (7)	0	20,000	20,000	20,000	20,000
Total Planned Banking Programs	20,000	40,000	40,000	40,000	40,000
Total Existing and Planned Supplies and Banking	117,060	121,660	134,980	140,680	145,380
Total Estimated Demand (w/o conservation) (8) (9)	110,100	120,300	128,900	141,200	152,100
Conservation (10)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Source: CLWA 2005; Table 6-3.
Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of single dry deliveries projected to be available for the worst case single dry year of 1977 (4% in 2010 and 5% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report " (May 2005).
(2) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).
(3) The total amount of water currently in storage is 50,870 af, available through 2013. Withdrawals of up to this amount are potentially available in a dry year, but given possible competition for withdrawal capacity with other Semitropic banking partners in extremely dry years, it is assumed here that about one third of the total amount stored could be withdrawn.
(4) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.
(5) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.
(6) Rosedale-Rio Bravo Water Banking and Recovery Program online in 2006, based on completing CEQA and subsequent adoption by CLWA Board of Directors.
(7) Assumes additional planned banking supplies available by 2014.

TABLE 2
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030

(8) Assumes increase in total demand of 10 percent during dry years.
(9) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 5).
(10) Assumes 10 percent reduction on urban portion of total normal year demand resulting from conservation best management practices ([urban portion of total normal year demand x 1.10] * 0.10), as discussed in Chapter 7.

TABLE 3
Projected Multiple-Dry Year Supplies and Demands (1)

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*32,010*	*32,910*	*32,570*	*32,570*	*32,570*
SWP Table A Supply (2)	30,500	31,400	31,400	31,400	31,400
Flexible Storage Account (CLWA) (3)	1,170	1,170	1,170	1,170	1,170
Flexible Storage Account (Ventura County) (3)	340	340	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation (4)	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	81,210	82,110	81,770	81,770	81,770
Existing Banking Programs					
Semitropic Water Bank (3)	12,700	0	0	0	0
Total Existing Banking Programs	12,700	0	0	0	0
Planned Supplies					
Local Supplies					
Groundwater	*6,500*	*6,500*	*6,500*	*6,500*	*6,500*
Restored Wells (Saugus Formation) (4)	6,500	6,500	5,000	5,000	5,000
New Wells (Saugus Formation) (4)	0	0	1,500	1,500	1,500
Recycled water (5)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (6)	11,000	11,000	11,000	11,000	11,000

TABLE 3
Projected Multiple-Dry Year Supplies and Demands (1)

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Total Planned Supplies	17,500	19,100	23,800	28,500	33,200
Planned Banking Programs					
Rosedale-Rio Bravo (7) (8)	5,000	15,000	15,000	15,000	15,000
Additional Planned Banking (8) (9)	0	5,000	15,000	15,000	15,000
Total Planned Banking Programs	5,000	20,000	30,000	30,000	30,000
Total Existing and Planned Supplies and Banking	116,410	121,210	135,570	140,270	144,970
Total Estimated Demand (w/o conservation) (10) (11)	110,100	120,300	128,900	141,200	152,100
Conservation (12)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Source: CLWA 2005; Table 6-4.
Notes:

(1) Supplies shown are annual averages over four consecutive dry years (unless otherwise noted).
(2) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of deliveries projected to be available for the worst case four-year drought of 1931-1934 (32% in 2010 and 33% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report " (May 2005).
(3) Based on total amount of storage available divided by 4 (4-year dry period). Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).
(4) Total Saugus pumping is the average annual amount that would be pumped under the groundwater operation plan, as summarized in Table 3-6 ([11,000+15,000+25,000+35,000]/4).
(5) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.
(6) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.
(7) Rosedale-Rio Bravo Water Banking and Recovery Program online in 2006, assuming CEQA complete and adoption by CLWA Board of Directors.
(8) Average dry year period supplies could be up to 20,000 af for each program depending on storage amounts at the beginning of the dry period.
(9) Assumes additional planned banking supplies available by 2014.
(10) Assumes increase in total demand of 10 percent during dry years.
(11) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 6).
(12) Assumes 10 percent reduction on urban portion of total normal year demand resulting from conservation best management practices ([urban portion of total normal year demand x 1.10] * 0.10), as discussed in Chapter 7.

Updated Water Supply Conditions

Draft State Water Project Delivery Reliability Report 2007

The recently released Draft SWP Delivery Reliability Report 2007 includes CalSim II simulations that were conducted to evaluate current (2007) SWP delivery reliability and incorporate actions to protect the delta smelt defined by the 2007 federal court ruling discussed in the CLWA Letter (i.e., *Natural Resources Defense Council, et al. v. Kempthorne*, Case No. 1:05-cv-01207-OWW-NEW). As described in the report, simulations to evaluate future (2027) SWP delivery reliability incorporate the current interim court-ordered operating rules related to delta smelt and a range of possible climate change impacts to hydrology in the Central Valley. The interim operating rules for delta smelt are simulated at a more-restricted level and a less-restricted level for Delta exports to provide a range of estimated water deliveries. Therefore, for 2007, two studies are conducted. For 2027, ten simulations are used to reflect the four assumed scenarios for climate change and the two levels of operating rules. Results of these updated CalSim II simulations are presented in the Draft SWP Delivery Reliability Report 2007 along side results from the 2005 SWP Reliability Report to help identify and explain impacts to delivery reliability due to actions to protect delta smelt and future climate change. Table 4 below, as shown in the Draft SWP Delivery Reliability Report 2007, indicates that under the updated Future Conditions (2027), average SWP delivery amounts may decrease from 8 to 11 percent of maximum Table A amounts compared to earlier estimates.

TABLE 4
SWP Table A Delivery from the Delta under Future Conditions

	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
Study of Future Conditions	**Thousand afy (taf/year)**	**Percent Maximum Table A[1]**	**Thousand afy (taf/year)**	**Percent Maximum Table A[1]**	**Thousand afy (taf/year)**	**Percent Maximum Table A[1]**
2005 SWP Reliability Report, Study 2025	3,178	77%	4,133	100%	187	5%
Update with 2027 Studies[3]	2,724-2,850	66-69%	4,133	100%	255-293	6-7%

Source: DWR 2007; Table 6-13.
Notes:
(1) Maximum Table A Amount is 4,133 taf/year.
(2) 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies.
(3) Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 5 below, also drawn from the Draft SWP Delivery Reliability Report 2007, includes estimates of SWP Table A deliveries for a single-year and multi-year droughts. It also includes the average of the Table A deliveries for comparison purposes.

TABLE 5
Average and Dry Period SWP Table A Deliveries from the Delta under Future Conditions

	SWP Table A Delivery from the Delta (in percent of maximum Table A[1])					
Study of Future Conditions	**Long-term Average[2]**	**Single dry-year (1977)**	**2-year drought (1976-1977)**	**4-year drought (1931-1934)**	**6-year drought (1987-1992)**	**6-year drought (1929-1934)**
2005 SWP Reliability Report, Study 2025	77%	5%	40%	33%	42%	38%
Update with 2027 Sudies[3]	66-69%	7%	26-27%	32-37%	33-35%	33-36%

Source: DWR 2007; Table 6-14.
Notes:

(1) Maximum Table A Amount is 4,133 taf/year.
(2) 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies.
(3) Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Draft State Water Project Delivery Reliability Report 2007 Applied to CLWA SWP Supplies

In addition to the CLWA Letter, supplemental information has been provided by CLWA that further describes the assumed updates to the information provided in the 2005 UWMP based upon the Draft SWP Delivery Reliability Report 2007. This additional information is presented in Table 6 through Table 8 below.

Table 6 provides an update of the projected average/normal year supplies and demand based primarily upon the Draft SWP Delivery Reliability Report 2007, as compared to the information presented in the 2005 UWMP, for the year 2030. In addition, CLWA has included certain updated information regarding other sources of supply. The updated supply figures affecting the water supply totals are shown in the highlighted cells in the table.

TABLE 6
Comparison of Projected Average/Normal Year Supplies and Demands

	2005 UWMP for the Year 2030	Revised Reliability for the Year 2030
Wholesale Imported	84,300	75,407
SWP Table A Supply	73,300	62,800
Buena Vista-Rosedale	11,000	11,000
Nickel Water – Newhall Ranch	0	1,607
Flexible Storage Account (CLWA)	0	0
Flexible Storage Account (Ventura County)	0	0
Groundwater Supplies	46,000	46,000
Recycled Water	1,700	1,700
Existing Banking Programs	0	0
Planned Supplies (Reflects Newhall Ranch Recycled Water)	15,700	21,100
Planned Banking Programs	0	0
Total Existing and Planned Supplies and Banking	**147,700**	**144,207**
Total Estimated Demand (w/o conservation)	**138,300**	**138,300**
Conservation	(12,900)	(12,900)
Total Adjusted Demand	**125,400**	**125,400**

Source: J. Ford, CLWA 2008.

As shown in Table 6, applying the 66 percent figure (most conservative of the 66-69 percent range shown in Tables 4 and 5 above) to CLWA's Table A Amount of 95,200 af, results in approximately 62,800 af expected under average Future Conditions (2027) according to the Draft SWP Delivery Reliability Report 2007. This is compared to 77 percent, or 73,300 af, included in the water supply planning in the 2005 UWMP in the year 2030 in an average year. In addition, CLWA has included 1,607 acre-feet per year (afy) of Nickel Water, and an additional 5,400 afy supply of recycled water from the Newhall Ranch Water Reclamation Plant. Neither of these sources of supply was included in the 2005 UWMP (personal communication, J. Ford, CLWA 2008).

Tables 7 and 8 below provide an update of the dry-year supplies and demand based primarily upon the Draft SWP Delivery Reliability Report 2007 as provided by CLWA. Table 7 reflects the update of 7 percent of CLWA's Table A Amount for the single-dry year and 32 percent for the multi-dry year (refer to Table 5 above), as compared to the information presented in the 2005 UWMP, for the year 2030. In addition, as in Table 6, CLWA has included certain updated information regarding other sources of supply. The updated supply figures affecting the water supply totals are shown in the highlighted cells in the table.

TABLE 7
Comparison of Projected Single-Dry Year Supplies and Demands

	2005 UWMP for the Year 2030	Revised Reliability for the Year 2030
Wholesale Imported	20,480	23,987
SWP Table A Supply	4,800	6,700
Buena Vista-Rosedale	11,000	11,000
Nickel Water – Newhall Ranch	0	1,607
Flexible Storage Account (CLWA)	4,680	4,680
Flexible Storage Account (Ventura County)	0	0
Groundwater Supplies	47,500	47,500
Recycled Water	1,700	1,700
Existing Banking Programs	20,000	20,000
Planned Supplies (Reflects Newhall Ranch Recycled Water)	35,700	41,100
Planned Banking Programs	20,000	20,000
Total Existing and Planned Supplies and Banking	**145,380**	**154,287**
Total Estimated Demand (w/o conservation)	**152,100**	**152,100**
Conservation	(14,200)	(14,200)
Total Adjusted Demand	**137,900**	**137,900**

Source: J. Ford, CLWA 2008.

TABLE 8
Projected Multiple-Dry Year Supplies and Demands

	2005 UWMP for the Year 2030	Revised Reliability for the Year 2030
Wholesale Imported	43,570	44,277
SWP Table A Supply	31,400	30,500
Buena Vista-Rosedale	11,000	11,000
Nickel Water – Newhall Ranch	0	1,607
Flexible Storage Account (CLWA)	1,170	1,170
Flexible Storage Account (Ventura County)	0	0
Groundwater Supplies	47,500	47,500

TABLE 8
Projected Multiple-Dry Year Supplies and Demands

	2005 UWMP for the Year 2030	Revised Reliability for the Year 2030
Recycled Water	1,700	1,700
Existing Banking Programs	15,000	15,000
Planned Supplies (Reflects Newhall Ranch Recycled Water)	22,200	27,600
Planned Banking Programs	15,000	15,000
Total Existing and Planned Supplies and Banking	**144,970**	**151,077**
Total Estimated Demand (w/o conservation)	**152,100**	**152,100**
Conservation	(14,200)	(14,200)
Total Adjusted Demand	**137,900**	**137,900**

Source: J. Ford, CLWA 2008.

The above discussion provides additional detail as it relates to the conclusion provided in the February 5, 2008 letter provided by CLWA to the Los Angeles County Department of Regional Planning, as well as the related additional updated information provided by CLWA (the information presented in Tables 6, 7 and 8). As described in the CLWA Letter, CLWA has determined that, while the injunction is in effect, there are sufficient water supplies available for pending and future residential and commercial developments within the CLWA service area for the foreseeable future through 2030 as set forth in the 2005 UWMP. As further described in the CLWA Letter, CLWA has concluded that CEQA Lead Agencies may rely on the 2005 UWMP, with the additional information related to the Draft SWP Delivery Reliability Report 2007, for the analysis of water supply impacts in CEQA documents, and in making a determination as to the adequacy of water supply for land use projects.

References:

CLWA (Castaic Lake Water Agency). 2005. 2005 Urban Water Management Plan. Prepared for the Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District, Valencia Water Company. November.

DWR (Department of Water Resources). 2007. Draft State Water Project Delivery Reliability Report 2007. December.

Ford, Jeff. Water Resources Planner, Castaic Lake Water Agency. Personal communication with M. Hood, February 19, 2008 and February 20, 2008.

CASTAIC LAKE WATER AGENCY

February 5, 2008

Mr. Bruce W. McClendon, FAICP
Director of Planning
Los Angeles County
Department of Regional Planning
320 West Temple Street
Los Angeles, CA 90012

Subject: Availability of Future Water Supply in the Santa Clarita Valley

Dear Mr. ~~McClendon~~ BRUCE:

In your September 21, 2007 letter (copy attached), you noted that reductions in local water supplies "...may invalidate portions..." of environmental impact reports for pending and future developments. This is the result of the reliability of water supply from the State Water Project (SWP) having been impacted by an injunction issued by a federal court. As a result, deliveries of SWP water were reduced starting last year.

On May 25, 2007, the court had ruled that a biological opinion (BO) supporting the "incidental take" of Delta smelt by SWP pumping operations was not in compliance with the federal Endangered Species Act. Accordingly, the court ordered the preparation of a new BO so that a permit could be granted to the SWP for the incidental take of the fish by the pumps. The injunction will be in effect until the new BO is completed. The same federal court issued a written court order on December 14, 2007 setting forth the "interim remedies" to protect the Delta smelt. It is the implementation of these interim remedies that reduces the availability and reliability of the SWP water supply.

In the meantime, CLWA and the four local water retailer staffs have been meeting with County and City of Santa Clarita planning staff over the last three months to coordinate water supply and land use planning activities for the Santa Clarita Valley. On January 28, 2008, the California Department of Water Resources (DWR) issued its "Draft State Water Project Delivery Reliability Report 2007" (Reliability Report), an assessment of the SWP supply availability and reliability. *Based on this new information, CLWA has determined that, while the injunction is in effect, there are sufficient water supplies available for pending and future residential and commercial developments within the CLWA service area for the foreseeable future through 2030 as set forth in the Santa Clarita Valley (SCV) Urban Water Management Plan (2005 UWMP).*

The Reliability Report addresses the effect that the injunction will have on SWP water availability. The purpose of the Reliability Report, which is updated and issued biennially, is to indicate how much SWP water is available for various hydrologic scenarios (i.e., normal, dry and critically dry years). This report is used by water agencies that have contracted for SWP water to determine SWP water supply availability and reliability as part of their determinations of *overall* water supply availability and reliability.

The Reliability Report includes additional and updated information that was not available in earlier Reliability Reports, along with an assessment of the impact of climate change on the SWP supply. This additional data, in conjunction with a more exact analysis of the operational impacts of the federal court injunction, will reduce the available water to CLWA from the SWP, but not as much as had been previously estimated.

The 2005 UWMP uses a 77% reliability factor for the SWP supply, which is taken from DWR's 2005 Reliability Report. In other words, CLWA's available SWP supply in the 2005 UWMP is equal to 77% of CLWA's SWP contract amount.

The Reliability Report, factoring in the effects of the injunction and using the most conservative of four climate change scenarios modeled by DWR, reduces that reliability to 66%. Using this lower figure (and certain changes and updated information regarding other sources of supply) to update the water supply figures in the 2005 UWMP, CLWA and the local purveyors believe there will be adequate supplies to meet demand as forecast in the 2005 UWMP through the year 2030. Therefore, while the injunction is in place, proposed projects can once again cite the 2005 UWMP, with the additional information provided by the Reliability Report, in their environmental documents as evidence of adequate water supplies to serve the projects under consideration.

The discussion of water supply in environmental documents should be tempered, though, by noting that the Reliability Report represents a reasonable scenario as required by the California Environmental Quality Act (CEQA), and would close the gap between the available supply and the demand in the future, thereby making the CLWA service area more subject to shortages in certain dry years. Accordingly, the reduction in SWP supply reinforces the need to continue diligent efforts to conserve potable water and increase the use of recycled water, both to meet the goals in the 2005 UWMP and to maximize utilization of our potable water supplies. CLWA and the purveyors will continue to work diligently with the County and City in preparing a Water Conservation Ordinance and the enforcement mechanisms to aggressively implement water conservation in the CLWA service area.

The injunction will be in force until the BO is issued, which is currently anticipated at the end of 2008. At that time, long-term reductions in SWP water availability will probably result from the mitigation requirements for the take permit that DWR is required to obtain to comply with the Endangered Species Act. These long-term reductions will likely require another update of the Reliability Report and water supply planning documents that affect land use planning decisions in the Santa Clarita Valley. It is expected that the mitigation requirements in the BO will be no greater than the operational restrictions of the injunction (i.e., the interim remedies); as such, the reductions in SWP water supply as a result of the granting of the Endangered Species Act permit should also be no greater than those required by the injunction.

After the long-term water supply reliability has been reassessed based on the mitigation requirements of the BO, CLWA will confirm that DWR's current estimate of SWP reliability is still applicable or if it needs to be updated, presumably by another Reliability Report. CLWA would then use this information to amend its 2005 UWMP, which would include identification of potential additional supplies to replace any necessary portion of CLWA's SWP supply that would have been lost as a result of the BO mitigation requirements.

In the meantime (i.e., during 2008 and part of 2009), based on the revised Reliability Report, local water retailers should be able to provide affirmative responses to requests for SB 610 Water Supply Assessments (WSAs) and SB 221 Water Verifications (WVs) for proposed projects. CEQA Lead Agencies may also rely on the 2005 UWMP, with the additional information provided by the Reliability Report, for the analysis of water supply impacts in CEQA documents, and in making a determination as to the adequacy of water supply for land use projects.

CLWA and the local water retailers – CLWA Santa Clarita Water Division, Los Angeles County Water Works District #36, Newhall County Water District and Valencia Water Company – look forward to working with the County in allocating water to proposed development in a consistent and equitable manner while at the same time ensuring that no water supply disruptions occur to our existing customers.

Sincerely,

Dan Masnada
General Manager

Attachment

cc: Mr. Paul Brotzman, Planning and Economic Development Director
City of Santa Clarita, Department of Regional Planning
Mr. Steve Cole, General Manager, Newhall County Water District
Mr. Robert DiPrimio, President, Valencia Water Company
Mr. Dean Efstathiou, Chief Deputy Director, Los Angeles County Department of Public Works
Mr. Mauricio Guardado, Retail Manager, Santa Clarita Water Division
Mr. Paul Novak, Planning Deputy, Los Angeles County Board of Supervisors

Los Angeles County
Department of Regional Planning

Planning for the Challenges Ahead

Bruce W. McClendon FAICP
Director of Planning

September 13, 2007

Castaic Lake Water Agency
Dan Masnada, General Manager
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

REC'D SEP 21 2007

Subject: Availability of Future Water Supply

Dear Mr. Masnada:

The recent decision handed down by U.S. District Judge Oliver Wanger appears to have significantly reduced the amount of water that Southern California will receive from the State Water Project. The Department of Regional Planning is requesting that your agency inform this Department of impacts that may affect pending and future residential and commercial developments within your agency's service area.

Possible reductions in local water supplies may invalidate portions of environmental impact reports related to development proposals currently awaiting public hearing. Therefore, it is urgent that your agency respond as soon as a reasonably accurate determination can be made.

Should you have any questions, please feel free to contact Mr. Paul McCarthy of my staff at (213) 974-6461 between 7:30 a.m. to 5:30 p.m., Monday through Thursday. Our offices are closed on Friday.

Sincerely,

DEPARTMENT OF REGIONAL PLANNING

Bruce W. McClendon, FAICP
Director of Planning

BWM:JS:FM:PM:rs

Attachment

C: County Counsel
Department of Public Works

State of California
The Resources Agency
Department of Water Resources

The State Water Project Delivery Reliability Report 2007

Draft

December 2007

Arnold Schwarzenegger
Governor
State of California

Mike Chrisman
Secretary for Resources
The Resources Agency

Lester A. Snow
Director
Department of Water Resources

Organization/author page pending.

Foreword

The water delivery reliability of the State Water Project (SWP) is at a crossroads. Future water deliveries to millions of Californians throughout the state will be impacted by many factors. Two of the most significant changes facing the system are Delta pumping restrictions and climate change.

This report provides a glimpse of our current path if no action is taken to address these and other factors affecting water delivery reliability. The report also identifies many other factors that could be changed to positively affect our water future.

Estimating the delivery reliability of the SWP depends on many issues, including possible future regulatory standards in the Delta, population growth, water conservation and recycling efforts, and water transfers. The impact of climate change on hydrology, consumptive use of water, fisheries and sea level rise must also be considered. This report evaluates the impacts of potential changes in hydrology of climate change. These other factors also need to be considered in the future. The stability of Delta levees, and therefore, SWP water deliveries, are threatened by earthquakes, land subsidence and floods.

On the positive side, there are significant and promising processes underway that could take us to a much more reliable and sustainable Delta water conveyance system for the SWP.

In this report, a possible future for these factors is presented. However, to the extent that these factors can be and are changed by actions over the next few years, this estimate of water delivery reliability will also change.

In Spring 2007, the State saw the first voluntary shutdown of the SWP pumps in the Delta to protect fish. Delta smelt and some other pelagic (open water) fishes have been in decline since the early 2000s for reasons that likely include the presence of invasive species, which have altered the basic food web in the Delta, and the impacts of toxics and water project operations. In 2007, water project operations changes in the Delta costing over 500,000 acre-feet were taken to help protect the endangered Delta smelt with the use of the Environmental Water Account. Unfortunately, these actions did not result in an increase in the abundance of Delta smelt in the fall of 2007 suggesting that more than just water project operational changes in the Delta are needed to increase Delta smelt abundance. In addition, another pelagic fish, the long-fin smelt, is now also being considered for listing under the State Endangered Species Act. Clearly, a more comprehensive approach to address the decline in pelagic fish is needed.

In December 2007, a federal court imposed interim rules that will significantly restrict the operations of both the SWP and the Central Valley Project while a new federal biological opinion for Delta smelt is written in 2008.

During 2007, new Delta planning processes efforts—including the Delta Vision process established by Governor Arnold Schwarzenegger and the Bay/Delta Conservation Planning process—have reached important conclusions about the need to change the way water is conveyed across or around the Delta to both better protect fish and provide a sustainable and reliable water supply for the State. Those efforts will continue into 2008.

This report on water delivery reliability of the SWP represents the current state of water affairs and future delivery scenarios if no action is taken. It shows a continued eroding of SWP water delivery reliability under the current method of moving water through the Delta and assumed near-term effects of climate change.

The estimates for current deliveries show that, when compared to the estimates in the *State Water Project Delivery Reliability Report, 2005*, total annual SWP deliveries decrease in 93% of the years based on the historical data used in the analysis. Water deliveries estimated for 20 years into the future are also presented as a range of values to capture the variability in the results of the climate change studies.

When compared to the future estimates in the 2005 report, total annual deliveries for 2027 show even greater decreases in a majority of years if no action is taken to address the factors causing this decrease in water delivery reliability. That is why DWR is, and will continue to be, at the forefront of efforts to improve conditions in the Delta that will protect the ecosystem and water supply reliability for 25 million Californians.

Lester A. Snow
Director
California Department of Water Resources

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Chapter 1
Introduction

The State Water Project (SWP) is primarily a water storage and delivery system intended to help close the gap in California between when and where precipitation primarily falls and when and where most water demands occur. Water from the SWP is a critical component of water supply for the twenty-nine state water contractors, who may also receive water from other sources. While each of the water supply contracts defines the maximum amount of water to be delivered annually, the amount of water actually delivered may range from somewhat to substantially less than this amount due to such factors as variable precipitation and runoff, physical and institutional limits on storage and conveyance, and variable contractor water demands. For communities receiving SWP water, the reliability of SWP water deliveries is a key factor for local planners and government officials estimating their own water supply reliability.

Since the 2005 SWP Delivery Reliability Report, DWR has updated its estimate of current (2007) and future (2027) SWP delivery reliability and has expanded the conditions under which reliability is quantified. The additional conditions are changes in hydrology due to potential climate change for the future and restrictions on SWP and CVP pumping in accordance with the interim operation rules imposed by the December 2007 Federal Court order.

The State Water Project Delivery Reliability Report 2007 first briefly describes the SWP and the Sacramento-San Joaquin Delta (Delta), the hub of water deliveries in California. Next, the general topic of water delivery reliability and how DWR calculates delivery reliability for the SWP are discussed. Then, key planning activities that may impact future SWP delivery reliability are summarized. These efforts are the Delta Vision process, the Bay Delta Conservation Plan, the Delta Risk Management Strategy, and the CALFED Ecosystem Restoration Program Conservation Strategy. Three areas of significant uncertainty to SWP delivery reliability are then presented: the recent and significant decline in pelagic organisms in the Delta (open-water fish such as delta smelt and striped bass), climate change and sea level rise, and the vulnerability of Delta levees' to failure. Next, the general approach to simulating SWP operations by CALSIM II for this report is discussed.

Results of CALSIM II studies are then presented which assume future climate change scenarios and SWP operations under high and low flow restrictions in the Delta. The assumed flow restrictions are designed to estimate the operation restrictions to be put in place by the federal court to protect delta smelt for water year 2008 and until replaced by new federal biological opinions.

Finally, the report provides guidance on how to apply the delivery estimates to water management plans. Presented in appendixes are detailed CALSIM II simulation assumptions and results and recent SWP deliveries.

This report does not include analyses of how specific water agencies should integrate SWP water supply into their water supply equation. This topic requires extensive information about local facilities, local water resources, and local water use, which is beyond the scope of this report. Moreover, such an analysis would require decisions about water supply and use that traditionally have been made at the local level. DWR believes that local officials should continue to fill this role.

Background

Purpose

This report on SWP delivery reliability is intended to ultimately assist local agencies, cities, and counties using SWP water in planning integrated water resources management to allow them to develop adequate and affordable water supplies for their communities. These activities are usually conducted in the course of preparing a water management plan such as the Urban Water Management Plans required by Water Code section 10610. The information in this report may be used by local agencies in preparing or amending their water management plans and identifying the new facilities or programs that may be necessary to meet future water demands. Local agencies and governments will also find in this report information that is useful in conducting analyses mandated by laws requiring water retailers to demonstrate whether their water supplies are sufficient for certain proposed subdivisions and development projects subject to the California Environmental Quality Act.

This report can be used with published guidelines which explain how to integrate SWP supply information with supply information from other sources to develop an overall reliability assessment of each contractor's total water portfolio. The Department has published two documents addressing this topic. DWR's *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001* (October 2003) includes suggestions on how local water suppliers can integrate supplies from various sources, such as the SWP, into their analyses. Another document is DWR's *Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan* (January, 2005). Both documents can be found on the DWR's Office of Water Use Efficiency home page at http://www.owue.water.ca.gov.

Reporting Requirements

As a result of a court-approved settlement agreement executed by the Planning and Conservation League, DWR, state water contractors and other entities in the wake of the Third Court of Appeal's ruling in the "Monterey Amendments" case in 2000, DWR has a legal duty to prepare biennial State Water Project delivery reliability reports. In that agreement, DWR committed to the following:

> Commencing in 2003, and every two years thereafter, the Department of Water Resources (DWR) shall prepare and deliver to all State Water Project (SWP) contractors, all city and county planning departments, and all regional and metropolitan planning departments within the project service area a report which accurately sets forth, under a range of hydrologic conditions, the then existing overall delivery capability of the project facilities and the allocation of that capacity to each contractor. The range of hydrologic conditions shall include the historic extended dry cycle and long-term average. The biennial report shall also disclose, for each of the ten years immediately preceding the report, the total amount of project water delivered and the amount of project water delivered to each contractor. The information presented in each report shall be presented in a manner readily understandable by the public. (Settlement Agreement Attachment B).

Previous Reports

The 2007 SWP Delivery Reliability Report is the third report of this type. The previous reports in 2003 and 2005 defined and calculated delivery reliability the same as in this report with output from DWR's CALSIM II model. This report is distinguished from those earlier reports by including estimates of the potential reductions to SWP delivery reliability due to the pelagic organism decline (POD) and future climate changes. The risk of conveyance disruption due to Delta levee failure is also discussed.

Context

The State Water Project

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants that extends for more than 600 miles. Its main purpose is to divert and store surplus water during wet periods and distribute it to service areas in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and Southern California. Other Project purposes include flood control, power generation, recreation, fish and wildlife protection, and water quality management in the Sacramento-San Joaquin Delta.

The keystone of the SWP is Lake Oroville which conserves water from the Feather River watershed. Lake Oroville is the SWP's largest storage facility with a capacity of about 3.5 million acre-feet. Releases from Lake Oroville flow down the Feather River into the Sacramento River, which drains the northern portion of California's Central Valley. The Sacramento River flows into the Sacramento-San Joaquin Delta, comprised of 738,000 acres of land interlaced with channels that receive runoff from about 40 percent of the State's land area. The SWP and the CVP rely upon Delta channels as a conduit to move water from the Sacramento River inflow to the points of diversion in the south Delta. Thus the Delta is actually part of the SWP conveyance system, making the Delta a key component in SWP deliveries. The significance of the Delta to SWP deliveries is described in more detail below.

From the northern Delta, Barker Slough Pumping Plant diverts water for delivery to Napa and Solano Counties through the North Bay Aqueduct. Near Byron in the southern Delta, the SWP diverts water into Clifton Court Forebay for delivery south of the Delta. Banks pumping plant lifts water from Clifton Court Forebay into the California Aqueduct, which channels the water to Bethany Reservoir. The water delivered to Bethany Reservoir from Banks Pumping Plant is either delivered into the South Bay Aqueduct for use in the San Francisco Bay area or continues down the California Aqueduct which transports water to O'Neil Forebay, Gianelli Pumping-Generating Plant, and San Luis Reservoir.

San Luis Reservoir is jointly operated by DWR and the Bureau of Reclamation (Reclamation) and has a storage capacity of more than 2 maf. DWR's share of gross storage in the reservoir is about 1.062 maf. Generally, water is pumped into San Luis Reservoir during late fall through early spring, and is temporarily stored for release back to the California Aqueduct to meet summertime peaking demands for SWP and CVP contractors.

SWP water not stored in San Luis Reservoir and water eventually released from San Luis continues to flow south through the San Luis Canal, a portion of the California Aqueduct jointly owned by DWR and Reclamation. As water flows through the San Joaquin Valley, deliveries of CVP supply are made through numerous turnouts to farmlands within the service areas of the CVP. Near Kettleman City, the Coastal Branch Aqueduct splits off from the California Aqueduct for water delivery to agricultural areas to the west and municipal and industrial water users in San Luis Obispo and Santa Barbara Counties.

The remaining water conveyed by the California Aqueduct travels further in the San Joaquin Valley to agriculture users such as Kern County Water Agency before reaching Edmonston Pumping Plant which raises the water up high enough to travel across the Tehachapi Mountains and into Antelope Valley. In Antelope Valley the Aqueduct divides into the East and West Branches. The East Branch carries water into Silverwood Lake and Lake Perris. Water in the West Branch flows to Quail Lake, Pyramid Lake, and Castaic Lake.

Twenty-nine state water contractors have signed long-term water supply contracts with DWR for a total of 4,173 taf per year. Signed in the 1960s, all contracts are in effect to at least 2035 and are essentially uniform. Each contract contains a schedule of the maximum amount of water the contractor may receive annually. This schedule is contained in a table referred to as *Table A*. The annual amount was designed to increase each year, with most contractors reaching their ultimate maximum amount in 1990. In most cases, SWP water is an important component of local water supplies. Five contractors use SWP water primarily for agricultural purposes and the remaining 24 contractors use SWP water primarily for municipal purposes. All available water is allocated annually in proportion to each contractor's annual Table A amount. Appendix A contains additional information on Table A.

The Sacramento-San Joaquin Delta

The Sacramento-San Joaquin Delta is a network of natural and artificial channels and reclaimed islands at the confluence of the Sacramento and San Joaquin Rivers. The Delta forms the eastern portion of the San Francisco estuary, receiving runoff from over 40 percent of the state's land area. It is a low-lowing region where sediment from the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras Rivers commingled with organic matter deposited by marsh plants. Covering 738,000 acres interlaced with hundreds of miles of waterways, much of the land is below sea level and relies on more than 1,100 miles of rather fragile levees for protection against flooding.

Because the SWP and the CVP use Delta channels to convey water to the southern Delta for diversion, the Delta is the focal point for water distribution throughout the state. In fact, the Delta is one of the few estuaries in the world that is used as a major source of drinking water supply: about one-quarter of California's drinking water comes from the Delta; two-thirds of Californians get some portion of their drinking water from the Delta. The Delta also provides a unique estuarine habitat for many resident and migratory fish and birds, some of which are listed as threatened or endangered. Most of the native fish either migrate through the Delta or move into it for spawning. Resident native fish are mainly present in areas strongly influenced by the Sacramento River inflows.

The CVP pumps at Jones Pumping Plant have a capacity of 4,600 cubic feet per second (cfs) and divert water directly from Old River. The CVP has contracts to divert 3.3 maf annually from the Delta for primarily agricultural use south of the Delta. The SWP pumps at Banks Pumping Plant have a combined pumping capacity of 10,300 cfs; however, diversions into the buffering Clifton Court Forebay are restricted to 13,870 acre-feet (af) daily and 13,250 af per day over a 3-day average. A rate of 13,250 af per day equates to an average pumping of 6,680 cfs.

CVP and SWP reservoir releases and Delta exports are coordinated according to the Coordinated Operating Agreement (COA) which sets guidelines for the sharing of supply and responsibility for meeting water quality standards in the Delta. The majority of the water exported by the SWP is dependent upon water rights derived from Lake Oroville storage; however, the SWP can also divert water considered in excess in the Delta. These excess conditions in the Delta usually result when there is sufficient inflow to meet all beneficial needs and the SWP is not required to make supporting releases from Lake Oroville. Diversions during excess Delta conditions are still governed by various determinations and rules.

In addition to the state and federal projects' diversions, irrigation water for use in the Delta is taken from channels and sloughs through approximately 1,800 diversions which can total over 5,000 cfs in July and August.

Delta water quality is primarily governed by the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta (1995 Bay-Delta Plan). This plan established beneficial uses, associated water quality objectives, and an implementation program. The State Water Resources Control Board (SWRCB) in Water Rights Decision 1641 assigned primary responsibility for meeting many of the Delta water quality objectives to the SWP and CVP. Key factors in determining water quality in the western Delta are the quality of important Delta inflows and the intrusion of ocean-derived salts associated with daily tides. The extent of this intrusion is primarily determined by the magnitude of Delta inflows, export pumping rates, and operation of the Delta Cross Channel. Delta inflows are normally at least partially regulated by upstream reservoir operations.

The water flowing in Delta channels are constrained by an extensive levee system that protects Delta islands from flooding. This protection is critical because land subsidence in the Delta, primarily due to the consuming oxidation of aerated peat soils, has placed most of the land in the Delta below sea level. In fact, the elevation of Delta islands can be more than 20 feet below sea level. The resulting difference between the elevations of Delta lands and the water surface in adjacent channels makes Delta levees vulnerable to failure. Land subsidence in the Delta is expected to continue in the future which will increase the vulnerability of levees to failure and subsequent island flooding.

Chapter 2
Water Delivery Reliability

As mentioned in the Introduction, estimates of SWP delivery reliability are intended to help local SWP water users assess their water supply reliability, a key measure of a system's ability to match water supplies with demand. Just how water delivery reliability is assessed is critical to whether it is a meaningful guide for such an analysis. This chapter presents DWR's method for calculating SWP delivery reliability, the factors affecting SWP delivery reliability, and the limitations to estimating future water delivery reliability.

Calculating SWP Delivery Reliability

For this report, "water delivery reliability" is defined as the annual amount of water that can be expected to be delivered with a certain numeric frequency. SWP delivery reliability is calculated using computer simulations based upon 82 years of historical data. The annual amounts of SWP water deliveries are ranked from smallest to largest and a probability is calculated for each amount. These results are often displayed as a graph, commonly referred to as an exceedence plot. They can also be presented in a tabular format.

Factors Affecting Water Delivery Reliability

The amount of the SWP water supply delivered to the state water contractors in a given year depends on the demand for the supply, amount of rainfall, snowpack, runoff, and water in storage, pumping capacity from the Delta, and legal constraints on SWP operation. Expressed in more general terms, water delivery reliability depends on three general factors: the availability of water at the source, the ability to convey water from the source to the desired point of delivery, and the magnitude of demand for the water.

Availability of Source Water

The availability of water at the source depends on the amount of rain and snow and water use in the source areas. For the SWP, the size of the April 1 snowpack in the Feather River watershed and the storage in Lake Oroville are key components of the annual estimation of the SWP's delivery capabilities over the April through September period.

Factors of Uncertainty

The inherent yearly variable location, timing, amount, and form of precipitation in California introduce some uncertainty to the availability of future SWP source water and hence future SWP deliveries. The approach of analysis of SWP deliveries by simulating an 82-year sequence based upon historical weather patterns restricts the subsequent simulation to no more extreme droughts or severe storms than have historically occurred. However, the 83-year sequence of weather patterns does produce a wide range of hydrologic events with which to evaluate the ability of the SWP to deliver water.

The second source of uncertainty in source water is due to climate change. Current literature suggests that global warming is likely to significantly impact the hydrological cycle, changing California's precipitation pattern and amount from that shown by the record. In fact, there is evidence that some changes have already occurred, such as an earlier beginning of snowmelt in the Sierras, an increase in winter runoff as a fraction of the total runoff, and an increase in winter flooding frequency. More variability in rainfall, wetter at times and drier at times, would place more stress on the reliability of existing flood management and water supply systems, such as the SWP.

Treating Availability of Source Water Issues in CalSim II Studies

The State Water Project operation analyses contained in this report are based upon operation simulations under an extended record of historical precipitation and adjusted historical runoff. The 82-year record of 1922-2003 runoff patterns in the studies simulating 2007 and 2027 levels of development have been adjusted as needed to reflect the current and future levels of development in the source areas by analyzing land use patterns and projecting future land and water use. These series of data are then used to forecast the amount of water available to the SWP under current and future conditions.

Potential changes in climate patterns are becoming better defined and studies have been done on potential impacts to SWP deliveries due to associated changing hydrology. In a 2006 DWR report, *Progress on Incorporating Climate Change into Management of California's Water Resources,* broad-brush estimates are made of the potential impact upon the SWP around the year 2050 if no additional conveyance facilities or upstream reservoirs were built. These climate change studies adjusted the 73-year historical record (1922-1994) of rainfall and runoff according to four scenarios: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0. These studies have been updated for this report by expanding the simulation period to 82 years (1922-2003).

DWR has estimated potential deliveries at the 2027 level. However, these estimates are based on the assumption that no changes will be made in either the way water is conveyance across the Delta or in the interim operating rules defined by the recent court order to protect delta smelt. These assumptions are not a prediction of the future but an assessment of the future if these things are not changed. In addition, these estimates must be viewed with caution given the uncertainty of the effects of climate change in the future and the simplifying assumptions required for the analyses.

Ability to Convey Source Water to the Desired Point of Delivery

The ability to convey source water to the desired point of delivery refers to the facilities available to capture and convey water and any institutional limitations placed upon the facilities. Uncertainty in SWP deliveries may be in part due to uncertainty in the ability to convey water. For the SWP, this uncertainty centers on the Delta.

Factors of Uncertainty

In general, SWP operations are closely regulated by Delta water quality standards established by the State Water Resources Control Board (SWRCB) and set forth in Water Rights Decision 1641. Even in the times SWP operations are left to the discretion of DWR, actions often require consultation with federal and state fish and wildlife agencies under its Endangered Species Act provisions. The evolving response to the continuing unexplained decline in many pelagic fish species since the early 2000's, and the legal challenges to SWP operation and ongoing planning activities related to the Delta's future are sources of uncertainty for SWP delivery reliability related to water conveyance.

On May 25, 2007, a U.S. judge found that the 2005 USFWS Biological Opinion for delta smelt was not consistent with the requirements of the Federal Endangered Species Act and must be rewritten. On August 31, 2007 the same judge established interim operating rules to protect delta smelt until USFWS rewrites the biological opinion. The interim operating rules set in-Delta flow targets in Old and Middle Rivers from late December through June that will restrict CVP and SWP pumping in 2008 and until the delta smelt biological opinion is rewritten. The process being undertaken to rewrite this Biological Opinion is discussed in Chapter 4.

Future sea level rise associated with climate change could increase the salinity in the Delta as higher ocean tides push saline water further inland. If Delta water quality standards remain the same, SWP pumping could become more restricted, at least under some hydrologic conditions.

Another potential uncertainty for SWP water conveyance through the Delta is the risk of interruptions in SWP diversions from the Delta due to levee failures. SWP source water enters the Delta through the Sacramento River and is conveyed to Banks Pumping Plant via Delta channels lined with fragile levees. If a levee fails, depending upon the location and the size of the adjacent island, the flow of water from nearby channels onto the affected island can draw saline water from Suisun and San Pablo Bays into the central Delta. In such an incident, SWP pumping at Banks Pumping Plant may have to be curtailed or ceased for a period of time to prevent drawing saline water into the south Delta and additional releases from Lake Oroville may be necessary to flush the Delta of the saline water. As discussed in Chapter 4, the likelihood of levee failures in the future is expected to increase.

Treating SWP Conveyance Issues in CalSim II Simulations

The 2007 base study in this report assumes current facilities and institutional limitations, which include Water Rights Decision 1641, export curtailments for the Vernalis Adaptive Management Plan (VAMP) as described in the 2004 OCAP, and the August 2007 court-ordered in-Delta flow targets in Old and Middle Rivers to protect delta smelt. Two levels of Old and Middle River flow targets are examined in the report. These assumptions are described in more detail in Chapter 6. For comparison, the 2027 studies in this report assume the same institutional limitations as the 2007 simulations regarding Delta water quality requirements, fish protection, and Delta flows will be in place 20 years in the future (2027); no facility improvements, expansions, or additions will be made to the SWP; and conveying water through the Sacramento-San Joaquin Delta will not be significantly interrupted by levee failures. These assumptions are not a prediction of the future but an assessment of the future if these conditions are not changed. As discussed in Chapter 3, there are several processes currently underway to further the discussion on the need for changes in water conveyance around the Delta to address many of the issues. The 2027 studies also incorporate assumptions about climate change, but do not account for sea level rise or the expected accompanying increase in Delta salinity because the tools to evaluate this impact of climate change have not yet been completed.

Also not included in this report are CALSIM II studies which reflect risk of levee failure. The impact on SWP deliveries due to a single or multiple levee failure event is highly dependent upon where the levee failures occur and the Delta conditions at the time. As the Draft DRMS Phase 1 Summary Report indicates, the impact on SWP deliveries can range from relatively minor to catastrophic for a large earthquake with extensive levee failures, depending upon whether the earthquake occurs under dry or wet Delta conditions. However, the same report points out that if multiple Delta islands are left flooded with openings to adjacent channels after a large-scale levee failure event, the volume of water that would move into and out of the Delta over a tidal cycle could actually increase, resulting in higher salinities in the west Delta. If Delta water quality standards remain unchanged, releases from Lake Oroville would most then likely need to increase above current levels to enable the same level of SWP pumping. The DRMS report also indicates that multiple levee failures and Delta island flooding due to flood flows may not significantly impact SWP deliveries due to the fresh water Delta-wide conditions which would exist at the time of flood flows. The topic of Delta levee vulnerability to failure is addressed in greater detail in Chapter 4.

Demand for System Water

Water demand in the delivery service area is affected by such factors as the magnitude and types of water demands, the extent of water conservation measures, local weather patterns, and water costs. Supply from a water system may be sufficiently reliable at a low level of demand but become less reliable as the demand increases. In other cases, the reliability of a water supply system to meet a higher demand may be maintained at its past level because new facilities have been added or the operation of the system has been changed. In general, the higher and the more time-concentrated the water demands, the more need for storage and conveyance capacity to achieve the same delivery reliability. For example, if the demand occurs only three months in the summer, a water system with a sufficient annual supply but insufficient water storage may not be able to reliably meet the demand. If, however, the same total amount of demand is distributed over the year, the same system could more easily meet the demand because the need for water storage is reduced.

Demand levels for the SWP water users in this report are derived from historical data and information received from the SWP contractors. Demand on the SWP is nearing the maximum contract amount (in other words, "Maximum Table A amount"). Each SWP contract contains a Table A, which states the maximum annual delivery amount over the period of the contract. These annual amounts usually increase over time. Most contractors' Table A amounts reached a maximum in 1990. The total of all contractors' maximum Table A amounts is 4.173 million acre-feet (maf) per year. Table A is used to define each contractor's portion of the available water supply that DWR will allocate and deliver to that contractor. The Table A amounts in any particular contract are not a guarantees of annual delivery amounts but are used to allocate individual contractors' portion of the total delivery amount available. Estimates of each contractor's amount of water delivered is determined by the factors described in this report. (See Appendix C for additional explanation and listing of the maximum Table A amounts).

Of the 29 SWP contractors, Yuba City, Butte County, and the Plumas County Flood Control and Water Conservation District are located north of the Delta. Their total maximum Table A amounts is 0.040 maf. The total maximum Table A amounts for the remaining 26 contractors, who all receive their supply from the Delta, is 4.133 maf. This report focuses on SWP deliveries from the Delta because the amount of water pumped from the Delta by SWP facilities is the most significant component of the total amount of SWP deliveries. The results presented in this report in terms of estimated delivered water supplies as a percent of Table A deliveries apply to contractors north of the Delta in the same manner as those contractors receiving supply from the Delta.

Factors of Uncertainty

Estimating future demand for SWP water requires assumptions be made about population growth, water conservation, recycling efforts, other sources of supply available to the SWP contractors, and climate change. The estimates are also dependent upon the cost to the SWP contractor for each of the components of their integrated water management plan. These factors are considered by the SWP contractors in the estimates of their current and future demands.

Treating Water Demand Issues in CalSim II Simulations

SWP Table A and Article 21 demands in the 2007 studies were assumed to be the same as those in the 2005 study from the 2005 SWP Delivery Reliability Report. SWP Table A and Article 21 demands in the 2027 studies were assumed to be the same as those in the 2025 study from the 2005 SWP Delivery Reliability Report. The demand values are assumed to vary from year to year depending upon the weather. Specific values used in the CalSim II studies are contained in Appendix A.

Limitations to Estimating Future Water Delivery Reliability

Studies Must Rely on Assumptions

Actual, historical water deliveries cannot always be used with a significant degree of certainty to predict future water deliveries. As discussed earlier, there are continual, significant changes over time in the determinants of water delivery for a specific water supply system. These changes include water storage and delivery facilities, water use in the source areas, water demand in the receiving areas, and the regulatory constraints on the operation of facilities for the delivery of water. Given the highly significant changes that have occurred for the SWP over the past 40 years, past deliveries are not a good predictor of SWP current deliveries, much less of future deliveries.

For example, the demand 30 years ago for water from the SWP was lower than it is currently or expected to be in the future. Past lower demand for SWP water resulted in less water being transported through the SWP during normal and wet times than could have been—or would have been if the demand for water had been higher. Less water was delivered then because less water was needed; the amount of source water and conveyance capabilities weren't limiting factors for deliveries. Conversely, the recent Court-ordered restriction on SWP exports from the Delta is estimated to reduce annual deliveries from what has been delivered in the recent past. Analyses estimating future SWP deliveries must include assumptions about future conditions. Some assumptions are very important to the analyses and are key to understanding the resulting estimates of annual water deliveries. A discussion of the important assumptions for the studies in this report follows.

Studies Assume Repeating Historical Weather Patterns

One of the most significant assumptions for water planning in general is how wet, dry and variable the weather will be. Until recently, assuming the future weather pattern would be similar to the past was sufficient for many planning purposes. Given the evolving information on the potential effects of global climate change in the future, this approach is no longer adequate. Incorporating climate change into future projections is difficult because of the many ways the patterns of rain, snow and temperature could shift. A way to measure some of the uncertainty is to analyze many potential climate change scenarios in order to capture the range of water supply impacts.

This report contains estimates for four future climate change scenarios. The scenarios are variations based upon the historical record of precipitation information for the Central Valley for the period 1922 through 2003. The amount and timing of rainfall and runoff is adjusted but the sequence of dry years or wet years is the same for all scenarios. Evaluating how water management systems will respond under severely dry periods is limited to assuming the worst droughts in the period of historical record. The worst multi-year drought on record is 1928 through 1934, although the brief drought from 1976 through 1977 is more acutely dry.

Other Important Assumptions

To identify the assumptions with the most effect on the estimates of SWP deliveries, DWR conducted a sensitivity analysis for assumptions in CalSim II model studies. In a sensitivity analysis, an assumption such as the amount of water used in the watershed above Lake Oroville is varied over several studies and the results for SWP deliveries are compared. This is done to assess how each assumption affects study results. The results of DWR's study are presented and discussed in the 2005 SWP Delivery Reliability Report. The parameters having the largest net impact on SWP Delta deliveries are Table A demands and Banks Pumping Plant limits. The most elastic parameters (i.e. parameters causing the most percent change in SWP deliveries per percent change in value) are Table A demands and Lake Oroville inflow. The estimates for the future inflow to Lake Oroville are dependent upon what is assumed for climate change. Legal limitations are one of the factors defining the rules for operating Banks Pumping Plant. Therefore, the assumptions for climate change and the Court-ordered restrictions directly affecting Banks Pumping Plant are ones which will significantly affect SWP delivery estimates.

Chapter 3
Status of Planning Activities which May Impact SWP Delivery Reliability

As discussed earlier, the Sacramento-San Joaquin Delta is an essential part of the conveyance system for the SWP. SWP pumping at Banks Pumping Plant is to a large extent regulated to protect the many uses of the Delta. However, there is a growing recognition that the current uses in the Delta are not sustainable over the long term under current management practices and regulatory requirements. Four major concurrent Delta planning efforts are underway with objectives related to providing a sustainable Delta. These plans may propose changes to SWP operations which in turn could affect SWP delivery reliability. These efforts are the Delta Vision, Delta Risk Management Strategy, the CALFED Ecosystem Restoration Program Conservation Strategy, and the Bay Delta Conservation Plan. Each could affect SWP and CVP operations in the Delta.

Delta Vision

On September 28, 2006, in conjunction with the signing of SB 1574, Governor Schwarzenegger signed an executive order to initiate the Delta Vision and establish an independent Blue Ribbon Task Force to develop a durable vision for sustainable management of the Sacramento-San Joaquin Bay Delta. The Delta Vision process is looking more broadly at the sustainability of the Delta. The Blue Ribbon Task Force has prepared its vision for sustainable management of the Delta (http://www.deltavision.ca.gov). A strategic plan to implement the vision will be the focus of the Task Force during 2008.

Key Points from the Task Force's vision are:

- The water system and the ecosystem of the Delta are co-equal values.
- The Delta is a unique place that has value in its own right.
- Future management must work with nature to achieve desired goals for the Delta.
- Design for resiliency by encouraging regional self sufficiency and developing alternative ways to move water among areas of the State.
- Separate water for human uses from water for the ecosystem.
- New storage and improved conveyance must be constructed to capture water at times least damaging to the environment.
- Over time, reliance on levees should be reduced. However, levees remain critical to the future of the Delta and new policies should match levels of protection provided to uses allowed.
- Assess dual conveyance systems as the preferred direction, to understand the optimal combination of through-Delta and isolated facility improvements against listed performance standards.

The Task Force also identified near-term actions that must be taken in the very near future. These focus on preparing for disasters in or around the Delta, protecting the Delta ecosystem and water supply system from urban encroachment, and quickly beginning work on short-term improvements to both the ecosystem and water supply system.

Delta Risk Management Strategy

The 2000 CALFED Record of Decision presented its Preferred Program Alternative describing actions, studies, and conditional decisions to help fix the Delta. Included in the Stage 1 implementation of the preferred alternative was the completion of a Delta Risk Management Strategy (DRMS) that would look at sustainability of the Delta and assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences and develop recommendations to manage the risk.

In 2005, the Legislature passed and the Governor signed AB 1200 which requires DWR to evaluate the potential impacts on water supply derived from the Delta based on 50-, 100-, and 200-year projections for possible impacts on the Delta due to subsidence, earthquakes, floods, climate change, and combinations of these drivers. DWR and DFG must determine the principal options for the Delta. DWR must then evaluate each option for addressing those impacts for its ability to, among other things, prevent the disruption of water supplies derived from the Delta, improve the water quality of drinking water supplies from the Delta, and maintain Delta water quality for Delta users. The Department of Fish and Game is to evaluate and comparatively rate each option for its ability to restore salmon and other fisheries that use the Delta. The study is to be completed by January 1, 2008. The DRMS Project was developed, in part, to address the provision in AB 1200 and is a major source of scientific and technical information on the Delta and Suisun Marsh levees for other major studies and initiatives including the Delta Vision initiative, the Bay Delta Conservation Plan, and the CALFED End of Stage 1 Assessment.

Prior to the initiation of DRMS study, no other levee risk assessment has been as comprehensive and complex. Due to the relatively short time for the assessment, DRMS made the best estimates possible based on existing available data and models. While data gaps exist, there were no opportunities to gather new data in the course of the DRMS effort. Results should be considered on a regional basis rather than for any individual island or levee reach. The results should be used for a broad understanding of the condition in the entire Delta, and should not be used as a basis for design for any specific location.

The DRMS preliminary findings have been reviewed by a CALFED scientific panel. The review has lead to a revaluation of some of the initial DRMS analyses. The results of the reevaluation will be incorporated into the final report and will be completed in April 2008. Delta Vision, the CALFED Ecosystem Restoration Program and the Bay-Delta Conservation Planning effort depend on the best available information from DRMS to support their own processes. The findings discussed in Chapter 4 should be viewed as a progress report that is subject to refinement. While specific numbers may change, the essence of the findings is expected to remain the same.

CALFED Ecosystem Restoration Program Conservation Strategy

The Ecosystem Restoration Program (ERP) implementing agencies are developing a Conservation Strategy to guide future ecosystem restoration implementation based on evaluation of past actions, new information, and changing understanding of the ecosystem. The Conservation Strategy is a guidance document for future ecosystem restoration implementation and is non-regulatory and based on willing seller participation. To date, the effort has focused on the Delta due to the emphasis focused on it by the pelagic organism decline (POD) and other planning efforts. In future versions, comparable conservation strategies will be developed for the entire ERP focus area including the Sacramento and San Joaquin River watersheds.

The Conservation Strategy is a biological view of where restoration of important habitat types could occur to restore ecosystem form and processes to the maximum extent. Areas have been identified in the Conservation Strategy with potential for various kinds of habitat restoration within the Delta-Suisun Marsh based upon existing elevations, habitat, and natural process requirements of pelagic organisms and other native fishes. Elevation and soil type are the drivers for this preliminary depiction which does not consider the constraints of water conveyance options, infrastructure, or land use patterns and ownership. As noted in the BDCP discussion that follows, new conveyance focuses on a new North of Delta diversion(s) from the Sacramento River, which would divert water for export around the Delta, offers the greatest potential for meeting ecosystem restoration objectives. The Conservation Strategy is also incorporating information from other Delta-related planning efforts (e.g., Delta Risk Management Strategy, Suisun Marsh Implementation Plan, the ERP End of Stage 1 Assessment, and recovery plans for Federally-listed species) and technical and public input.

The draft of the strategy focuses on five broad habitat categories for restoration or management in the Delta. These categories include managed wetland and wildlife friendly agriculture (primarily subsided islands), inter-tidal, floodplain, upland transition, and grassland/vernal pool transition corridor.

Information on ecosystem processes, such as hydrodynamics, temperature, salinity, residence times, and productivity is being developed. Details on restoration actions that address flow and river operations—the primary drivers of aquatic systems and habitats—will be incorporated once the Delta Regional Ecosystem Restoration Implementation Plan conceptual models (January 2008) and the anadromous fish recovery plans (Spring 2008) are completed and in coordination with the BDCP process.

Bay-Delta Conservation Plan

The Bay-Delta Conservation Plan (BDCP) has a different and more specific purpose than DRMS and Delta Vision. BDCP is being developed consistent with the federal Habitat Conservation Plan (HCP) and State Natural Community Conservation Planning (NCCP). The purpose of BDCP is to develop a conservation plan that resolves the conflict between fishery protection under the State and federal Endangered Species acts and water operations of the State Water Project (SWP), Central Valley Project (CVP) and Mirant Power facilities in the legal Delta. The goal of BDCP is to develop a plan that satisfies both the conservation and water supply goals of the Planning Agreement signed in October 2006. The BDCP Steering Committee is composed of 19 groups that represent the State and federal water agencies and export contractors, non-governmental organizations representing environmental and farming interests, and Mirant Power, with the State and federal fishery agencies serving as ex-officio members. BDCP is ultimately focused on satisfying permitting requirements for the water supply system in the Delta. Among other things, the plan will:

- Provide for conservation and management of at-risk fish species impacted by the covered activities.
- Preserve, restore, and conserve aquatic, riparian and associated terrestrial habitats.
- Provide clear expectations and regulatory assurances for Delta water operations and facilities (CVP, SWP, and Mirant Corporation).

The steering committee for BDCP has been actively working since April 2007 to set the scope and focus of this planning effort. The committee initially developed ten options. These options were narrowed to four options for conveyance and opportunities that provide for habitat restoration and enhancement.

- **Option 1: Existing Through-Delta Conveyance.** This option includes use of existing through-Delta conveyance with physical habitat restoration in the north and west Delta and Suisun Marsh (about 28 percent of BDCP planning area).
- **Option 2: Improved Through Delta Conveyance.** This option includes improving through-Delta conveyance with operable barriers on some channels, separating water supply conveyance flows from the San Joaquin River, and providing habitat restoration in the north, west, central and south Delta and Suisun Marsh (about 35 percent of the BDCP planning area).
- **Option 3: Dual Conveyance.** This option is similar to Option 2 with the addition of an isolated conveyance facility from the Sacramento River to the south Delta export facilities.
- **Option 4: Peripheral Aqueduct.** This option includes construction of a peripheral aqueduct from the Sacramento River to the south Delta export facilities, which would allow habitat restoration throughout the Delta and Suisun Marsh (about 75 percent of the BDCP planning area).

The following table shows a summary of how the BDCP Steering Committee consultant ranked the options during the evaluations.

The BDCP is targeting having a draft of the conservation plan by the end of 2008 and the associated draft Environmental Impact Report/Environmental Impact Statement available for public review at the end of calendar year 2009.

Table 3-1 Overall comparison of BDCP options by criteria category (rank)[1]

Evaluation Criteria Category	Conservation Strategy Option			
	Option 1: Existing. Through Delta	**Option 2:** Improved Through Delta	**Option 3:** Dual Conveyance	**Option 4:** Peripheral Aqueduct
Biological	●	●●	●●●	●●●●
Planning	●	●	●●●●	●●●●
Flexibility/Sustainability/Durability	●	●●	●●●	●●●●
Impacts on Other Resources	●●●●	●●●	●	●●

Notes: 1. Performance ranks are:
●●●● = Best performing
●●● = Second best performing
●● = Third best performing
● = Lowest performing

Where ranks are equal, the options receive the same rank

Chapter 4
Areas of Significant Uncertainty for SWP Delivery Reliability

Delta Vision's recognition that the current uses in the Delta are not sustainable in the long term is in large part based upon three major growing concerns: the pelagic organism decline, possible impacts from climate change and sea level rise, and the vulnerability of Delta levees for failure. Each of these uncertainties for SWP delivery reliability is discussed below.

Pelagic Organism Decline

In late 2004 and early 2005, scientists became concerned about the numbers of many pelagic (open water) organisms including delta smelt that had been declining sharply since the early 2000's. Other pelagic fish with very low numbers in the Delta are striped bass, longfin smelt, and threadfin shad. By 2005, the decline was widely recognized as a serious issue and became known as the Pelagic Organism Decline (POD). Hypothesized factors contributing individually or in concert to lower pelagic productivity are: 1) toxic effects, 2) exotic species effects, and 3) water project effects. Studies over the last 3 years are indicating that all these factors might be contributing to the decline in pelagic fishes, and their relative importance might vary depending upon the year, season, and location within the Delta. Continued decline in the abundance of juvenile delta smelt led to a voluntary modification in 2007 in SWP and CVP operations to reduce the reversed flows in Middle and Old Rivers—a modification made possible through the Environmental Water Account (discussed below). Subsequently on May 31, 2007 DWR ceased Delta pumping and Reclamation reduced pumping to the minimum operating level of 850 cubic feet per second (cfs). SWP pumping resumed on June 10 at a minimal level of 90 cfs and slowly ramped up to 5,000 cfs by July 1.

In 2007, the Pelagic Fish Action Plan (Resources Agency, 2007), developed jointly by DWR and DFG, made several recommendations related to actions that could be taken to improve protection of pelagic fish, including delta smelt These actions included ways to increase primary productivity in the Delta, reduce the effects of toxics, and possible changes in water project operations. The actions related to SWP and CVP operations guided the voluntary actions taken by DWR and USBR in 2007 as part of the EWA.

Environmental Water Account and POD

The POD is occurring despite the operation since 2001 of the Environmental Water Account (EWA). This CALFED water management tool was created to provide added protection to at-risk fish species at no uncompensated costs to SWP and CVP water deliveries. The purpose of the EWA is to enable modifying water project operations in the Delta to provide protection for fish while also compensating for any water supply lost to SWP and CVP water users. Under EWA, fish protection is achieved by periodic curtailment of SWP and CVP water diversion from the Delta to water users south of the Delta and replacing any lost water supply at a later date. EWA does this through buying water from willing sellers or diverting surplus water when safe for fish, then banking, storing, transferring, and releasing the water as needed to protect fish and compensate water users. In its simplest terms, the EWA is aimed at adding flexibility to the state's water delivery system by providing water at critical times to meet environmental needs without reducing SWP and CVP water deliveries. Funding for the EWA is expected to continue through 2008. Without the compensation for the supply effects due to restricted pumping, SWP water supply reliability will be reduced. The studies in this report assume no EWA will be in place under the current and future scenarios.

Biological Assessment of the SWP and CVP Operating Criteria and Plan

In 2004, Reclamation and DWR developed a new Operating Criteria and Plan (OCAP) for the SWP and Central Valley Project (CVP). This plan documented many aspects of the SWP and CVP: detailed project descriptions, explanations of regulatory and legal requirements, changes in project operations since the last OCAP in 1992, and analyzed the present and proposed future operations using computer simulations. OCAP provided the project descriptions required for a comprehensive biological assessment of SWP and CVP. The biological assessment analyzed existing and potential effects of SWP and CVP operations on listed species and led to Endangered Species Act (ESA) consultation with the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries to update biological opinions (BO) for delta smelt, winter-run salmon, and other species listed under the ESA. In 2004, USFWS issued a non-jeopardy BO with regards to impacts on delta smelt caused by revised operations of the CVP and SWP. This opinion was updated in 2005. USFWS concluded that any adverse effects from the CVP and SWP operations would be avoided or minimized by conservation and adaptive management measures included in the OCAP.

The USFWS's 2005 BO for delta smelt was challenged in U.S. District Court. This court ruled in May of 2007 that the OCAP BO for delta smelt was inconsistent with the Federal Endangered Species Act and needed to be rewritten. On December 14, 2007 the court established interim operating rules to protect delta smelt while USFWS rewrites the BO. These interim operating rules are similar to the 2007 Pelagic Action Plan in that they include in-Delta flow limits in Old and Middle Rivers which have the effect of restricting CVP and SWP pumping.

Assessment of Possible POD Impacts on SWP Delivery Reliability

As previously discussed in Chapter 2, a crucial impact of POD upon SWP delivery reliability is to cause additional restrictions on SWP operations. These constraints introduce uncertainty in the ability to convey SWP source water to the desired point of delivery. This uncertainty can be somewhat addressed in analyses by assuming two levels of restrictions. The 2007 and 2027 studies in this report assume constraints to Old and Middle Rivers flow in accordance to the August 2007 court ruling on interim actions to protect delta smelt. These simulations are described in more detail in Chapter 6.

Climate Change and Sea Level Rise

Climate change is identified in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management. This is because climate change may seriously affect the State's water resources, particularly SWP's ability to deliver water. In fact, the 2005 report by the University of California, Berkeley for the California Energy Commission, *Climate Change and Water Supply Reliability*, asserts that climate change in California "is likely to affect water users primarily through its impact on supply reliability and uncertainty" (p. 4).

For the SWP, climate change has the potential to simultaneously affect the availability of source water, the ability to convey water, and users' demands for water. These changes are described below. Three climate warming scenarios prepared by the California Climate Change Center predict slightly warmer winters with less winter snowpack. In fact, some changes in hydrology due to climate change may already be noticeable, such as an earlier beginning of snowmelt in the Sierras, an increase in winter runoff as a fraction of the total runoff, and an increase in winter flooding frequency. Also, spring and summer runoff in the Sacramento River and San Joaquin River watersheds may be declining due to reduced snowpack.

In the future, average winter flood flows to the Delta are likely to become larger due to more intense storms with more precipitation occurring as rain instead of snow. This shift from snow to rain, particularly in the northern Sierra Nevada, is expected to shift the timing of the peak runoff toward the winter. This in turn may require adjustments to reservoir flood control operations—water managers may be forced to make changes in reservoir operations and flood-control rule curves—resulting in less spring and summer Delta inflows and an increase in Delta salinity.

Climate change experts believe that the timing and quantity of available water supplies in the coming decades may be less predictable due to changing climatic conditions (DWR's 2006 report, *Progress on Incorporating Climate Change into Management of California's Water Resources*). This may exacerbate the existing mismatch in California between where and when precipitation occurs and where and when people use water.

The sea level has been rising at an average rate of about 0.08 inches per year and is now about 0.6 feet higher at the Golden Gate than it was in 1920. The Intergovernmental Panel on Climate Change currently estimates that sea level will rise by about 0.6 to 1.9 feet over the next 100 years (URS Corporation and Jack R. Benjamin & Associates, 2007). Even if Delta levees are fully upgraded, sea level rise could negatively impact water supply reliability through increased salinity intrusion in the Delta. A further tightening of drinking water quality standards or increases in salinity or other constituents could significantly increase the cost of treating Delta water for municipal use. Increased salinity in the Delta reduces the opportunity for exporters to blend the less saline Delta water with other sources higher in salinity. If current in-Delta water quality standards are maintained in the future, re-operation of upstream reservoirs would be needed to provide more water for controlling the seasonal salinity intrusion in the Delta. This would likely result in generally lower reservoir levels, perhaps reducing the ability to meet water supply and water quality needs during dry periods.

Assessment of Possible Climate Change Impacts on SWP Delivery Reliability

As previously discussed in Chapter 2, climate change can potentially affect SWP delivery reliability by altering the timing and amount of source water. In 2006 DWR released a report on climate change and its potential impact on California's water resources. Entitled *Progress on Incorporating Climate Change into Management of California's Water Resources*, the report summarizes recent research into changes in precipitation, air temperatures, snow levels, rainfall, and snowmelt runoff. The report also evaluates possible future impact on California water supply through CalSim II simulations with hydrologic sequences which reflect different scenarios of climate change. In order to account for the uncertainty in future climate change, four scenarios are examined: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0.

Some of the main results of the 2006 climate change report related to estimated impacts on the SWP and Delta around the year 2050 are:

- Estimated changes in annual average SWP south-of-Delta Table A deliveries range from a slight increase of about 1 percent for a wetter scenario to about a 10 percent reduction for one of the drier climate change scenarios.

- Estimated increased winter runoff and lower Table A allocations result in slightly higher annual average Article 21[1] deliveries in the three drier climate change scenarios. However, the boosts in Article 21 do not offset losses to Table A. The wetter scenario with higher Table A allocations result in fewer Article 21 delivery opportunities and slightly lower annual average Article 21 deliveries.

- Estimated SWP carryover storage is reduced in the drier climate change scenarios and is somewhat increased in the wetter climate change scenario.

Sea level rise effects on water project operations to repulse a greater salt water intrusion under these conditions were not examined due to lack of existing tools for that type of analysis.

[1] Article 21 water is interruptible water allocated under certain conditions: SWP's share of San Luis Reservoir is full or projected to fill in the near term; other SWP reservoirs are full or at their storage targets, or conveyance capacity to fill these reservoirs is maximized; releases from upstream reservoirs plus unregulated inflow exceed the water supply needed to meet Sacramento Valley in-basin uses; Table A deliveries are being fully met; and the Banks Pumping Plant has spare capacity.

For this report, the Calsim II simulations were updated to incorporate an extension of the hydrologic simulation sequence to 2003 and operation of the SWP to meet the interim operating rules of the August 31, 2007 court order related to delta smelt. The same four scenarios of future climate change were simulated. It should be noted that these scenarios assume greenhouse emissions for 2050, not at the 2027 level assumed for Future Conditions. This report estimates climate change impact to SWP deliveries by interpolating between future studies which assume no climate change and studies which assume 2050 emissions. This approach is detailed in Appendix B. These studies are the best available estimates for future SWP water deliveries. These simulations along with all other simulations presented in this report are described in Chapter 6.

Vulnerability of Delta Levees for Failure

Delta levees provide constant protection from flooding because most lands in the Delta are below sea level. However, most of the Delta's levees do not meet modern engineering standards and are highly susceptible to failure. Levees are subject to failure at times of high flood flows, but also at any time of the year due to seepage or the piping of water through the levee, slippage or sloughing of levee material, or sudden failure due to an earthquake. The risk of levee failure in the Delta is significant, as shown by the fact that virtually all levees in the Delta have failed at least once over the past 100 years, with about half failing at least twice. Since 1900, there have been 166 levee failures.

A breach of one or more levees and island flooding will impact Delta water quality and water operations. Depending upon the hydrology and the size and locations of the breaches and flooded islands, a significant amount of saline water may be drawn into the interior Delta from Suisun and San Pablo Bays. At the time of island flooding, exports may be drastically reduced or ceased to evaluate the salinity distribution in the Delta and to avoid drawing higher saline water toward the pumps. The introduced salinity then could become dispersed and degrade Delta water quality for a prolonged period because of complex relationships between Delta inflows, tidal mixing, and the time taken to repair the breaches.

A large earthquake in the Delta causing significant levee failures and island flooding could lead to multi-year disruptions in water supply, significant water quality degradation, as well as permanent flooding of multiple islands. Such permanent multi-island flooding would probably lead to increased salt water intrusion into the Delta during seasonal low inflows. Maintaining Delta water quality when several islands are flooded and breaches are open would require additional Delta inflow because the volume of water coming into the Delta on the flood tide increases, requiring more fresh water from the rivers to prevent the saline water from extending into the Delta. When SWP and CVP pumping is restarted, Delta inflow would need to increase again beyond the pumping amount in order to prevent water quality degradation in the Delta. This chain of events would significantly impact water supply reliability by limiting pumping and requiring additional reservoir releases to generate the needed higher Delta inflows. A worst case scenario for water supply impacts would be a moderate or large earthquake causing extensive levee failure in the late summer or fall of a dry year.

The levee break on Middle River and subsequent flooding of Upper Jones Tract in 2004 is a small-scale example of this phenomenon. Following the break, Delta pumping was curtailed for several days to prevent seawater intrusion. Water shipments down the California Aqueduct were continued through unscheduled releases from San Luis Reservoir. Also, Shasta and Oroville reservoir releases were increased to provide for salinity control in the Delta.

A growing concern about the long-term viability of the Delta's levee system led to the initiation of the Delta Risk Management Strategy (DRMS).

Delta Risk Management Strategy

The 2000 CALFED Record of Decision presented its Preferred Program Alternative that described actions, studies, and conditional decisions to help fix the Delta. Included in the Stage 1 implementation of the preferred alternative was the completion of a Delta Risk Management Strategy (DRMS) that would look at sustainability of the Delta and assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences and develop recommendations to manage the risk.

Assembly Bill 1200, passed in 2005, directs DWR to evaluate the potential impacts of subsidence, earthquakes, floods, and climate change to Delta-based water supply. After determining principal options for the Delta, DWR must then evaluate each option according to its ability to prevent the disruption of water supplies derived from the Delta, improve the water quality of drinking water supplies from the Delta, and maintain Delta water quality for Delta users. By providing important information on levees in the Delta and Suisun Marsh, the DRMS Project is intended to support other major studies and initiatives including the Delta Vision initiative, the Bay Delta Conservation Plan, and the CALFED End of Stage 1 Assessment.

DWR defined Phase 1 of DRMS as the risk analysis of levee failures and associated potential economic, environmental, and public health and safety impacts and Phase 2 as the development and evaluation of strategies to reduce risks from levee failures. Risk analysis includes the likely occurrence of future earthquakes of varying magnitudes in the region, future rates of subsidence given continued farming practices, the likely magnitude and frequency of storm events, and the potential effects associated with global climate change (sea level rise, climate change, temperature change). Estimated risks to the Delta were made for 50-, 100-, and 200-year projections since risk can be expected to increase with time.

One reason for conducting a risk analysis is to quantitatively consider the uncertainties that relate to the performance of levees. Sources of uncertainty that affect any analysis can be fundamentally different. Events in nature such as precipitation are inherently random and this uncertainty cannot be reduced by simply collecting more information; rather, this uncertainty can be predicted in terms of probability.

The Draft DRMS Phase 1 Report looked at several hazards to levees: seismic events that cause levee failures, flood flows that can overtop levees or cause levee failure by increased pressure and seepage, undetected problems during non-flood flow periods, and erosion due to high wind waves. The level of risk of failure of Delta levees was determined by considering: the frequency of different magnitudes of hazards that can challenge the integrity of Delta levees, how vulnerable different levees reaches are to hazards, how hazards and levee vulnerabilities combine to produce levee failure, and the economic and ecosystem impacts due to levee failure. The analysis assumes that existing regulatory and management practices will continue in the future.

Potential Interruption/Disruption of SWP Deliveries Due to Earthquakes

A strong earthquake impacting the Delta could cause simultaneous levee failures on several islands, and there is a real possibility of multiple simultaneous island flooding. DRMS considered scenarios which consisted of different combinations of flooded islands, ranging from 1 island to 30 islands flooded. Table 4-1 summarizes impacts of various scenarios of island flooding associated with a single seismic event as presented in the URS/Jack R. Benjamin & Associates report, *Draft Summary Report, Phase 1: Risk Analysis, Delta Risk Management Strategy (DRMS)*, June 2007.

Preliminary analysis indicates that some water may not be treatable by municipal agencies for many months beyond those listed in Table 4-1 due to high organic carbon concentrations. This would extend the period that Delta water supply would be unavailable for urban users.

Table 4-1 Expected impact on Delta exports due to salinity intrusion from various seismic events

Seismic Case	Number of Flooded Islands	Duration of repairs to levees (months)	Duration of no pumping (months)	Water Not Exported (maf)
1	1	Up to 20	Up to 2	Up to 0.7
2	3	19	1 to 3	0.1 to 1.0
3	3	23	1 to 4	0.1 to 1.2
4	10	45	2 to 10	0.7 to 2.5
5	20	62	11 to 21	6.3 to 6.5
6	30	81	16 to 23	6.5 to 9.3

Key findings of the Draft Phase 1 DRMS report on possible impacts on SWP deliveries due to earthquakes are:

- Considering the probability of all seismic levee breaches under existing conditions, about 115 levee failures can be expected during 100 years.
- There is about a 28% chance of 30 or more islands simultaneously failing during a major earthquake in the next 25 years.
- A moderate to large earthquake capable of causing multiple levee failures could happen within the next 25 years. Under such an earthquake, extensive levee failure would most likely occur in the west and central Delta. Levee repairs could take up to 6.5 years and exports from the Delta could be disrupted for up to 2 years with a loss of up to 9.3 maf of water.
- By 2050, the frequency of island flooding from seismic events is expected to increase by 12 percent over 2005 conditions, if a seismic event has not occurred.

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specific numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Potential Interruption/Disruption of SWP Deliveries Due to Floods

During an average year, about 85 percent and 10 percent of the total Delta inflow comes from the Sacramento and San Joaquin rivers respectively. The remaining Delta inflow primarily comes from three eastside tributaries. Inflow from the Sacramento and San Joaquin rivers depends on reservoir releases, precipitation, and snowmelt. Over the long-term, many different combinations of high flood flows in the Sacramento and San Joaquin rivers are possible because of the large geographical extent of the two rivers' watersheds and the variability in storm paths. DRMS considered magnitude and frequency of flooding in different parts of the Delta from different sources to evaluate the probability of these high flows. This approach allows the inclusion in the risk analysis of floods that are possible but larger than have been historically recorded. The DRMS report views an analysis which relies only on historical data as likely to underestimate risk.

Potential disruption of Delta exports due to flood events and levee failures would depend upon the number of flooded islands, the timing and size of the flood flows, and the water quality in the Delta and Suisun Bay at the time of the flood. However, during such high flow events, there would normally be little or no impact on water quality at the exports due to levee failures and DRMS assumes no significant impact on Delta exports.

Key findings of the Draft Phase 1 DRMS report on possible impacts on SWP deliveries due to flood flows are:

- By 2050, Delta flood hazard is expected to increase 200% due to sea level rise and more frequent high flows.
- By 2050, the frequency of island flooding from flood events is expected to increase over 2005 conditions.
- By 2050, flood fragility of levees is expected to increase 10% due to subsidence, and overall Delta island flood frequency is expected to increase 230%.
- By 2050, the frequency of flood events is expected to increase by 50 percent and levees are expected to become 20 percent more vulnerable to flooding due to increased seepage and stability problems associated with further subsidence and sea level rise.
- By 2050, the combined effects of increased levee vulnerability and flood flows indicates an expected increase in island flooding from flood flows of 80 percent.

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specific numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Potential Interruption/Disruption of SWP Deliveries Due to "Sunny Day" Event

A "sunny day" levee failure is a failure which occurs during non-flood times and is not caused by an earthquake. Possible causes of levee failure include wave action, animal activity, and seepage. DRMS reports that, on average, there will be about 5.4 sunny-day breaches with 50 years of exposure in the Delta. These types of levee failures are not expected to involve the potential of simultaneous multi-levee events as could happen with high flood flows and a large earthquake.

Combined Potential Interruption/Disruption of SWP Deliveries

DRMS evaluated combined risk of levee failure due to earthquakes, floods, and "sunny day events" as well as how risks may change in the future. Key findings by DRMS are:

- Taking into account the probability of all levee breaches from all hazards under 2005 conditions, the number of levee failures in the Delta can be expected to about double over the next 100 years.
- Levee hazards are expected to grow larger in the future due to such factors as sea level rise and more frequent flood flows which will put more pressure on the levees.
- The overall likelihood of a major Delta event causing extensive levee failure is increasing as is the magnitude of the consequences from a given event.
- There is a possible range of sea level rise of from 0.7 to 4.6 feet over the next 100 years, depending upon on the assumed future greenhouse gas emissions and the forecast model used. Current estimates by the Intergovernmental Panel on Climate Change indicate that sea level will rise from 0.6 to 1.9 feet over the next 100 years. The CALFED Independent Science Board (ISB) has recommended that for planning purposes incorporating sea level rise, we should use the full

range of variability of 50-140 cm (20-55 in.)

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specific numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Emergency Operations Plan

As part of its efforts to reduce impacts to the SWP should a levee failure occur, DWR has initiated the development of an Emergency Operations Plan (EOP), a plan that provides procedures for emergency preparedness and incident management activities typically necessary for a jurisdiction and/or organization with emergency response roles and responsibilities. While DWR has current general procedures for emergency response, the EOP will ultimately enhance the State's ability to prepare for, respond to, and recover from a Delta levee failure disaster and will provide DWR with a plan focused specifically on a catastrophic levee failure disaster. The EOP will be a blueprint for coordinating the protection of life and property with its local, State, and Federal partners in taking the steps necessary to protect the State's water system.

DWR has completed the first of two phases of engineering design work intended to enhance the State's current ability to respond to large-scale levee failures or floods in the Delta. In the first phase, DWR conducted a discovery process to analyze previously developed plans and procedures and to identify current DWR capabilities for response to emergencies and disasters in the Delta. This phase included: developing plans to determine the quantity and gradation of rock needed to repair multiple levee breaches and block certain river channels in order to minimize salinity intrusion into the interior of the Delta, securing strategic joint stockpile/transfer facilities, completing design requirements and contracting for the construction of a new belt conveyor system, and establishing new procurement contracts for rock to be placed at the stockpile/transfer facilities. Through this process, DWR has categorized response actions that can be taken to reduce the impact of a Delta levee failure disaster. The first phase, now complete, has resulted in a DWR report, *Delta Emergency Operations Plan Concept Paper April 2007*. This report can be accessed at http://www.dfm.water.ca.gov/er/.

In the second phase, DWR will engage its partners in local, State, and Federal government, and in the private sector, to develop a detailed EOP for responding to levee failure events, stabilizing the system, and facilitating recovery. The EOP will be consistent and in compliance with California's Standardized Emergency Management System (SEMS)[2] and with the National Incident Management System (NIMS)[2]. Through the process of developing the EOP, DWR will improve preparedness capabilities for response and recovery.

[2] SEMS is an emergency management system required by California Government Code Section 8607(a) for managing incidents involving multiple jurisdictions and agencies. NIMS is a nationwide, Federal emergency management approach, for managing incidents with all levels of government, private-sector, and nongovernmental organizations working together. For further SEMS/NIMS information, please visit this website: http://www.oes.ca.gov/Operational/OESHome.nsf/1?OpenForm

Chapter 5
General Approach for Assessing SWP Delivery Reliability Through CalSim II Computer Simulations

CalSim II, a computer model jointly developed by DWR and Reclamation, simulates much of the water resources infrastructure in the Central Valley and Delta region of California. CalSim II models all areas that contribute flow to the Delta. The geographical coverage includes the Sacramento River Valley, the San Joaquin River Valley, the Sacramento-San Joaquin Delta, the Upper Trinity River, and the CVP and SWP service areas. CalSim II simulates operation of the CVP-SWP system using a monthly time step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period.

General Solution Techniques and Incorporating Operational Constraints

CalSim II routes water through a CVP-SWP system network representation. The network includes over 300 nodes and over 900 arcs, representing 24 surface reservoirs and the interconnected flow system. The physical description of the system is expressed through a user interface with tables outlining the system characteristics. CalSim II uses logic for determining deliveries to north-of-Delta, and south-of-Delta CVP and SWP contractors. The delivery logic uses runoff forecast information, which incorporates uncertainty and standardized rule curves (i.e. Water Supply Index versus Demand Index Curve). The rule curves relate forecasted water supplies to deliverable "demand," and then use deliverable "demand" to assign subsequent delivery levels to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as runoff forecasts become more certain. The south-of-Delta SWP delivery is determined based on water supply parameters and operational constraints. The CVP system-wide delivery and south-of-Delta delivery are also determined using water supply parameters and operational constraints with specific consideration for export constraints.

Hydrology

The historical flow record is adjusted for the influence of land-use change and upstream flow regulation in order to represent the possible range of water supply conditions. The hydrology used by CalSim II was developed jointly by DWR and Reclamation. Water diversion requirements (demands), stream accretions and depletions, rim basin inflows, irrigation efficiency, return flows, non-recoverable losses, and groundwater operation are components that make up the hydrology used by CalSim II. Sacramento Valley and tributary basin hydrologies are developed using a process designed to adjust the historical sequence of monthly stream flows to represent a sequence of flows at a future level of development. Adjustments to historic water supplies are determined by imposing future level land use on historical meteorological and hydrologic conditions. San Joaquin River basin hydrology is developed using fixed annual demands and regression analysis to develop flow accretions and depletions. The resulting hydrology represents the water supply available from Central Valley streams to the CVP and SWP at a future level of development. Groundwater has only limited representation in CalSim II. This resource is modeled as a series of interconnected lumped-parameter basins. Groundwater pumping, recharge from irrigation, stream-aquifer interaction and interbasin flow are calculated dynamically by the model.

Demands

SWP demands are preprocessed independent of CalSim II and vary according to the specified scenario (e.g., 2007, 2027) and according to hydrologic conditions. Agricultural land-use-based demands are calculated from an assumed cropping pattern and a soil moisture budget. Urban demands are typically set to contract amount, but with reductions in wet years based on recent historical data. Both land-use-based demands, and estimated contract amounts serve as upper bounds on deliveries. Environmental demands such as minimum reservoir storage requirements, minimum in-stream flows and deliveries to national wildlife refuges, and wildlife management areas are as stipulated in current regulatory requirements and discretionary interagency agreements.

Meeting Delta Water Quality Standards

CalSim II uses DWR's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates DSM2 model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations. The ANN flow-salinity model estimates electrical conductivity at the following four locations for the purpose of modeling Delta water quality standards: Old River at Rock Slough, San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville. In its estimates, the ANN model considers antecedent conditions up to 148 days, and considers a "carriage-water" type of effect associated with Delta exports.

CalSim II Priorities in Water Deliveries

CalSim II allocates water according to the four priorities shown in Table 5-1. Highest priority is given to prior right water users, minimum in-stream flow requirements and water quality requirements. While CVP and SWP contractor deliveries take precedence over next year's storage, a balance between the two is struck in the allocation decision to ensure that enough water is left in storage at the end of the year in case of impending drought.

Table 5-1 CalSim II water use prioritization

First	Prior-right water users, minimum in-stream flow requirements, water quality requirements
Second	SWP Table A contractors, CVP contractors
Third	Reservoir storage for the next year (carryover)
Fourth	SWP Article 21 deliveries

Table A and Article 21 Deliveries

The CalSim II simulations in this report estimate SWP delivery amounts for Table A and Article 21. As mentioned in Chapter 2, Table A is the contractual method for allocating available supply, and the total of all maximum Table A amounts for deliveries from the Delta is 4.133 million acre-feet (maf) per year. Article 21 refers to a provision in the contract for delivering water that is available in addition to Table A amounts. (See Appendices A and B for more discussion.) Article 21 of SWP contracts allows contractors to receive additional water deliveries only under specific conditions. These conditions are:

1. The water is available only when it does not interfere with Table A allocations and SWP operations;
2. The water is available only when excess water is available in the Delta;
3. The water is available only when conveyance capacity is not being used for SWP purposes or scheduled SWP deliveries; and

4. The water cannot be stored within the SWP system. In other words, the contractors must be able to use the Article 21 water directly or be able to store it in their own system.

Water supply under Article 21 becomes available only during wet months of the year, generally December through March. Because an SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of the SWP, not all SWP contractors can take advantage of this additional supply.

The importance of Article 21 water to local water supply is tied to how each contractor uses its SWP supply. For those SWP contractors who are able to store their wet weather supplies, Article 21 supply can be stored by being put directly into a reservoir or by offsetting other water that would have been withdrawn from storage, such as local groundwater. In the absence of storage, Article 21 water is not likely to contribute significantly to local water supply reliability. Incorporating supplies received under Article 21 into the assessment of water supply reliability is a local decision based on specific local circumstances, facts, and level of water supply reliability required. This report presents information on Article 21 water separately so local agencies can determine whether it is appropriate to incorporate this supply into their analyses.

CalSim II Performance

Some of the comments to the Draft 2003 SWP Delivery Reliability Report expressed concern about the accuracy of CalSim II and the credibility of conclusions about SWP delivery reliability that are based upon CalSim II simulations. In order to respond to these concerns, DWR conducted several CalSim II studies. In one study, results from a CalSim-II simulation using historical input from 1975 to1998 was compared to historical operations. This study is documented in the report, *CalSim-II Simulation of Historical SWP/CVP Operations, Technical Memorandum Report, November 2003* and was provided in Appendix E of the 2005 SWP Delivery Reliability Report. In a second study, a sensitivity analysis was performed to quantify the effects of various inputs on CalSim II results. Two performance measures were used, the Sensitivity Index and Elasticity Index, to quantify the sensitivity of twelve model output responses to twelve different model input parameters. This sensitivity study was also provided in Appendix E of the 2005 SWP Delivery Reliability Report.

In a follow-up study, DWR staff conducted a more detailed analysis of the sensitivity results, focusing on the delivery reliability of SWP system. The results of this analysis are documented in an internal memorandum report, dated April 30, 2007. The purpose of this analysis was to assist SWP contractors and other interested parties in evaluating the impact of model input parameters on SWP deliveries (SWP Delta deliveries, SWP north-of-Delta deliveries, and SWP deliveries under Article 21) with respect to a selected subset of input parameters. This memorandum report is available via the internet at http://baydeltaoffice.water.ca.gov/ by clicking on the announcement of the Draft SWP Delivery Reliability Report – 2007 under "Items of Interest".

Recent Improvements to CalSim II Simulations

The SWP operation simulations in this report use the CalSim II model developed for the 2004 Long-Term Central Valley Project Operations Criteria and Plan (OCAP) which was then modified specifically for these studies. In addition to the modifications needed for the 2007 Wanger decision, the 2004 OCAP version was modified to include the improvements listed below. A complete list of model assumptions is included in Appendix A. The new enhancements to CalSim II are:

- ***Improved representation of the San Joaquin River Basin***

  The previous San Joaquin River Basin representation was replaced by the San Joaquin River Water Quality Module version 1.00 (SJRWQM) developed by U.S. Bureau of Reclamation Mid-Pacific Region. The SJRWQM is an update to previous versions that has gone through extensive agency review and a formal peer review.

- ***Improved modeling of flow-salinity relationships in the Delta***

  The previous Artificial Neural Network (ANN) used to estimate flow-salinity relationships has been replaced with a newer more accurate version. The new ANN and its accompanying implementation to the CalSim II model produces salinities that match more closely to Delta Simulation Model 2 (DSM2) salinities.

- ***An extended hydrologic sequence***

  The Hydrologic sequence of 74 simulated years has been extended to 82 years, from the period of water years 1922 through 1994 to the period of water years 1922 through 2003.

Chapter 6
CalSim II Model Simulations and Assessment of Present and Future SWP Delivery Reliability

CalSim II simulations were conducted to evaluate current (2007) SWP delivery reliability and incorporate actions to protect delta smelt defined by the 2007 federal court ruling. Simulations to evaluate future (2027) SWP delivery reliability incorporate the current interim court-ordered operating rules related to delta smelt and a range of possible climate change impacts to hydrology in the Central Valley. The interim operating rules for delta smelt are simulated at a more-restricted level and a less-restricted level for Delta exports to provide a range of estimated water deliveries. Therefore, for 2007, two studies are conducted. For 2027, ten simulations are used to reflect the four assumed scenarios for climate change and the two levels of operation rules. By using these interim court-ordered operating rules in the studies, DWR is not making an assumption about the results of the ongoing discussions to revise the delta smelt Biological Opinion. The studies are simply an indication of the near-term impacts of these interim operating rules. The update of this report for 2009 will be done using operating rules defined by the revised delta smelt Biological Opinion.

Results of these updated CalSim II simulations are presented along side results from the 2005 SWP Reliability Report to help identify and explain impacts to delivery reliability due to actions to protect delta smelt and future climate change. At the end of the chapter, the information presented earlier is presented in a way to easily compare the estimated SWP deliveries under Current Conditions to those under Future Conditions.

This chapter contains tables summarizing the updated estimated delivery amounts of the studies for the entire study period (1922-2003), dry years, and wet years and presents information on the estimated probability of SWP Table A delivery amounts currently and twenty years in the future. While two CalSim II simulations were made to estimate current delivery reliability (bookends for delta smelt protection) and ten simulations were made to estimate future delivery reliability (combinations of flow constraints and climate change scenarios), simulation results in this chapter for Future Conditions are presented in terms of ranges in values for ease of analysis. The annual values for SWP deliveries estimated by all the CalSim II simulations are listed in tables in Appendix B. These tables also show the annual Table A demands assumed for each study.

The results indicate potentially significant differences between the updated studies and studies done for the 2005 report under both current and future conditions for estimated deliveries during multiple-year dry periods. In general, updated estimates of both current and future SWP Table A deliveries are less than the deliveries presented in the 2005 report, particularly during multiple dry years. For a given probability of exceedence, current and future SWP Table A deliveries are also less than were presented in the 2005 report. For future conditions, the probability of an annual Table A delivery exceeding 1.7 maf is substantially less than was presented in the 2005 report. The updated studies show generally higher SWP Table A deliveries under future conditions compared to current conditions, but decreases in deliveries in the future are possible during multiple dry year periods, depending upon which climate change scenario is assumed. In comparison, the 2005 report showed more frequent and greater increases in future deliveries.

Assessment of SWP Delivery Reliability under Current Conditions

Current Conditions refer to those conditions which are believed in effect in 2007. These conditions, described below, include Old and Middle River flow targets from the current court-ordered interim operating rules. Results from CalSim II simulations for the 2005 SWP Delivery Reliability Report under the 2005 study are presented throughout this section for comparison purposes. A detailed list of the study assumptions for this report is presented in Appendix A.

Availability of Source Water

The 2005 level of development (level of water use in the source areas) is assumed to be representative of 2007. The hydrologic sequence of simulated years is based upon historical precipitation and runoff patterns and is from water years 1922 through 2003. The hydrologic sequence for the 2005 report is shorter, from water years 1922 through 1994. For comparison purposes, these differences are not significant.

Demand for Delta Water

The SWP contractors' Table A demands for deliveries from the Delta assumed for 2007 are shown in Table 6-1. The assumed demands for the studies were developed in discussions with SWP water contractors and stakeholders involved in the development of the analyses associated with DWR's 2007 document, *Draft Environmental Impact Report: Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)*. A range in Table A demands is shown because the demand is assumed to vary each year with the weather.

Table 6-1 presents key demand values. Differences between the values in updated studies and the 2005 study in the 2005 report are due to the longer simulation period for the current report. SWP Article 21 demands for water are the same as assumed in the 2005 reliability report and are shown in Table 6-2.

Table 6-1 SWP Table A demands from the Delta under Current Conditions

Study of Current Conditions	Average Demand		Maximum Demand		Minimum Demand	
	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]
2005 SWP Reliability Report, Study 2005	3290	80%	3862	93%	2321	56%
Update with 2007 studies	3308	80%	3864	94%	2323	56%

1/ 4,133 taf /year.

Table 6-2 Article 21 demands from the Delta under Current Conditions

Study of Current Conditions	Average Article 21 demand (taf) Dec-Mar	Average Article 21 demand (taf) Apr-Nov	Total (taf/year)
2005 SWP Reliability Report, Study 2005	704	607	1311
Update with 2007 studies	699	598	1297

Ability to Convey Source Water to the Desired Point of Delivery

The CalSim II simulations assume that current Delta water quality regulations (contained in the State Water Resources Control Board's Decision 1641) are in place for the 2007 studies. The simulations also incorporate flow restrictions of the recent court-ordered interim operating rules related to Delta smelt. Two CalSim II simulations were run to evaluate a lower level and a higher level of flow restrictions to give a range of potential SWP water delivery estimates. The specific rules for these flows are contained in Table 6-3. The lower- and higher-level restrictions are the same for December 25 through February 20 and April 15 through May 15. They are significantly different during February 21 through April 14 and May 16 through June 30. Additional information on the characterization of the potential Court decision in the model is found in Appendix A. The amount of exports allowed while achieving the Old and Middle River flow targets are assumed shared equally between the CVP and the SWP. Combined CVP and SWP exports also are assumed constrained according to the June 30, 2004 Long-Term Central Valley Project Operations Criteria and Plan during April 15 to May 15. This operation is part of the Vernalis Adaptive Management Plan. The specific rules for this restriction are included in Appendix A.

Table 6-3 Old and Middle River flow target scenarios assumed in CalSim II studies

Period	Action Combined Average Old River and Middle River flow[1]	
	Less Restrictive Actions	More Restrictive Actions
Dec 25 – Jan 3	Less than 2,000 cfs flow in upstream direction	Less than 2,000 cfs flow in upstream direction
Jan 4 – Feb 20	Less than 5,000 cfs flow in upstream direction	Less than 5,000 cfs flow in upstream direction
Feb 21 – April 14	Less than 5,000 cfs flow in upstream direction	Less than 750 cfs flow in upstream direction
Apr 15 – May 15	No Old and Middle River flow constraint; VAMP controls exports	No Old and Middle River flow constraint; VAMP controls exports
May 16 – May 31	Less than 5,000 cfs flow in upstream direction	Less than 750 cfs flow in upstream direction
Jun 1 – Jun 30	Less than 5,000 cfs flow in upstream direction	Less than 750 cfs flow in upstream direction

1/ combined Old and Middle River flow calculated to be 0.58*(flow at Vernalis)-0.913*(SWP export +CVP export)

The simulation of current conditions in the 2005 report also assumed D-1641 Delta standards and combined SWP and CVP pumping restrictions according to the 2004 Long-Term Central Valley Project Operations Criteria and Plan. However, the 2005 report assumed no Old and Middle River flow targets.

Presentation of CalSim II Results

For the purpose of describing SWP deliveries under Current Conditions in this chapter, the annual deliveries from the two CalSim II simulations, which assumed a higher and a lower level of Old and

Middle River flow targets, are averaged. The annual SWP Table A and Article 21 deliveries for the two 2007 simulations are presented in Appendix B.

SWP Table A Deliveries under Different Hydrologic Scenarios

Table 6-4 contains the average, maximum, and minimum estimates of Table A deliveries from the Delta under current conditions from the 2005 SWP reliability report and under 2007 assumptions which include Old and Middle River flow targets. As previously mentioned, SWP deliveries under 2007 conditions are the result of averaging annual deliveries from two scenarios of Old and Middle River flow targets. The estimated probabilities for a given amount of annual SWP delivery under Current Conditions are presented in Figure 6-1.

Table 6-4 SWP Table A delivery from the Delta under Current Conditions

Study of Current Conditions	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]
2005 SWP Reliability Report, Study 2005	2818	68%	3848	93%	159	4%
Update with 2007 studies[3]	2595	63%	3711	90%	243	6%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2007 studies
3/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

Table 6-4 shows that under updated Current Conditions, average SWP delivery amounts may decrease 5% of maximum Table A when compared to the earlier estimate, from 68% to 63%. Since SWP Table A demands are the same between the earlier and updated studies, this decrease in deliveries is primarily due to the Old and Middle River flow targets to protect delta smelt reducing the amount of Delta water available for export by the SWP. The maximum delivery of 93% for the 2005 study is reduced to 90% for the updated study. The estimate of minimum SWP Table A delivery actually increases slightly. This is primarily due to the larger amount of storage available in Oroville Reservoir at the beginning of the year. The higher amount of storage is due to the fish-protection restrictions on SWP Delta pumping for the previous year reducing the need to release water from Oroville Reservoir.

Table 6-5 includes estimates of SWP Table A deliveries for Current Conditions under an assumed repetition of historical drought periods. The years are identified as dry by the Eight River Index, a good indicator of the relative amount of water supply available to the SWP. The Eight River Index is the sum of the unimpaired runoff from the four rivers in the Sacramento Basin used to define water conditions in the basin plus the four rivers in the San Joaquin Basin, which correspondingly define water conditions in that basin. The eight rivers are the Sacramento, Feather, Yuba, American, Stanislaus, Tuolumne, Merced, and San Joaquin. Table 6-5 also includes the average deliveries for comparison purposes. Once again, deliveries under 2007 current conditions are the result of averaging annual deliveries from two scenarios of Old and Middle River flow targets.

Table 6-5 Average and dry period SWP Table A deliveries from the Delta under Current Conditions

Study of Current Conditions	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Long-term Average[2]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Reliability Report, Study 2005	68%	4%	41%	32%	42%	37%
Update with 2007 studies[3]	63%	6%	34%	35%	35%	34%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2007 studies
3/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

Table 6-5 shows that estimates of updated SWP deliveries under Current Conditions during dry periods are less than were earlier estimated. SWP deliveries may be reduced to 34% of maximum Table A during the two-year drought of 1976-1977. The 6-year drought of 1987-1992 is estimated to provide 35% of maximum Table A, a reduction of 289 taf/year when compared to the 2005 estimate. The 4-year drought of 1931-1934 is the exception with SWP deliveries estimated to increase 3% of maximum Table A, from 32% to 35%.

Table 6-6 summarizes SWP Table A deliveries under an assumed repetition of historical wet periods under Current Conditions. As with drought years, the Eight River Index is used to identify wet years. Table 6-6 shows that estimates of SWP deliveries under updated Current Conditions do not significantly change from earlier estimates during wet years. Decreases in SWP deliveries for these wet periods generally range from 0 to 2% of maximum Table A (83 taf/year).

Table 6-6 Average and wet years SWP Table A delivery from the Delta under Current Conditions

Study of Current Conditions	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Long-term Average[2]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Reliability Report, Study 2005	68%	60%	65%	69%	75%	72%
Update with 2007 studies[3]	63%	60%	66%	68%	73%	71%

1/ 4,133 taf/year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2007 studies
3/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

Article 21 Deliveries under Different Hydrologic Scenarios

State Water Project water delivery is a combination of both Table A deliveries and the use of Article 21 by some contractors to store water locally at times when extra water and capacity is available beyond that needed by normal SWP operations. Table 6-7 contains the average, maximum, and minimum SWP Article 21 deliveries over the 1922-1994 period for the earlier study and the 1922-2003 period for the updated simulations. Comparing the estimates of SWP Article 21 deliveries, the updated estimates show significantly less delivery amounts on average and for maximum delivery over the simulation period. Estimated average Article 21 deliveries are 175 taf less under the updated Current Conditions than was estimated in the 2005 report. Estimated maximum Article 21 delivery is reduced 520 taf. These reductions are primarily due to the storage in San Luis Reservoir being lower in the 2007 studies. The reservoir is lower because Delta pumping is restricted by the court-ordered operation rules for delta smelt. To assure Table A deliveries for the coming year are not reduced, the SWP portion of San Luis Reservoir must be very close to full, if not completely full, before Article 21 deliveries are made.

Table 6-7 Annual SWP Article 21 delivery from the Delta under Current Conditions

Study of Current Conditions	Average delivery[1] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Reliability Report, Study 2005	260	1110	0
Update with 2007 studies[2]	85	590	0

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2007 studies
2/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

As noted above, water available for Article 21 comes only in wet periods and it is difficult to evaluate impacts except to look at specific years. Table 6-8 shows the updated and earlier estimates of Article 21 deliveries by year during dry periods. Under the updated Current Conditions, Article 21 deliveries are estimated to be significantly reduced during the dry periods 1929-1934, 1976-1977, and 1987-1992.

Table 6-9 shows the updated and earlier estimates of Article 21 deliveries by year during the 1978-1987 wet period. Under Current Conditions, updated estimated Article 21 delivery can decrease up to 550 taf in an individual year, compared to earlier estimates. In only one year, 1980, does the estimated Article 21 deliveries increase when compared to earlier estimates.

Table 6-8 Average and dry year SWP Article 21 delivery under Current Conditions (taf per year)

Year	2005 SWP Reliability Report Study 2005	Update with 2007 studies[2]	Year	2005 SWP Reliability Report Study 2005	Update with 2007 studies[2]
1929	0	0	1987	550	0
1930	120	0	1988	0	0
1931	0	0	1989	0	0
1932	240	0	1990	0	0
1933	510	40	1991	0	0
1934	210	0	1992	0	0
1976	190	5	Long-term average[1]	260	85
1977	0	0			

1/ 1922-1994 for 2005 SWP Delivery Reliability Report
1922-2003 for Update with 2007 studies
2/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

Table 6-9 Average and wet year SWP Article 21 delivery under Current Conditions (taf per year)

Year	2005 SWP Reliability Report Study 2005	Update with 2007 studies[2]
1978	300	100
1979	160	0
1980	140	190
1981	550	0
1982	800	490
1983	400	400
1984	550	460
1985	0	0
1986	120	30
1987	550	0
1978-87 Average	360	170
Long-term Average[1]	260	85

1/ 1922-1994 for 2005 SWP Delivery Reliability Report
1922-2003 for Update with 2007 studies
2/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

SWP Table A Delivery Probability

The probability that a given level of SWP Table A amount will be delivered from the Delta is shown for Current Conditions in Figure 6-1. Results from the 2005 SWP Reliability Report and updated estimates for 2007 are shown. Updated (2007) estimates of probability for current conditions is shown as a single line which results from ranking the averaged deliveries from the two scenarios of Old and Middle River flow targets. Probability graphs for each of these two scenarios are presented in Appendix B. To use Figure 6-1, one would first locate the percent exceedence of interest along the horizontal axis (x-axis) of the graph, move vertically upward to the curve, then horizontally to the vertical axis (y-axis) and read the annual delivery. For example, for an 80% exceedence, corresponding annual SWP Delta deliveries would be 2,277 taf from previous estimates and 1,990 taf for the updated estimates. The numerical data for this figure is included in Appendix B and should be referenced for specific values corresponding to specific exceedences.

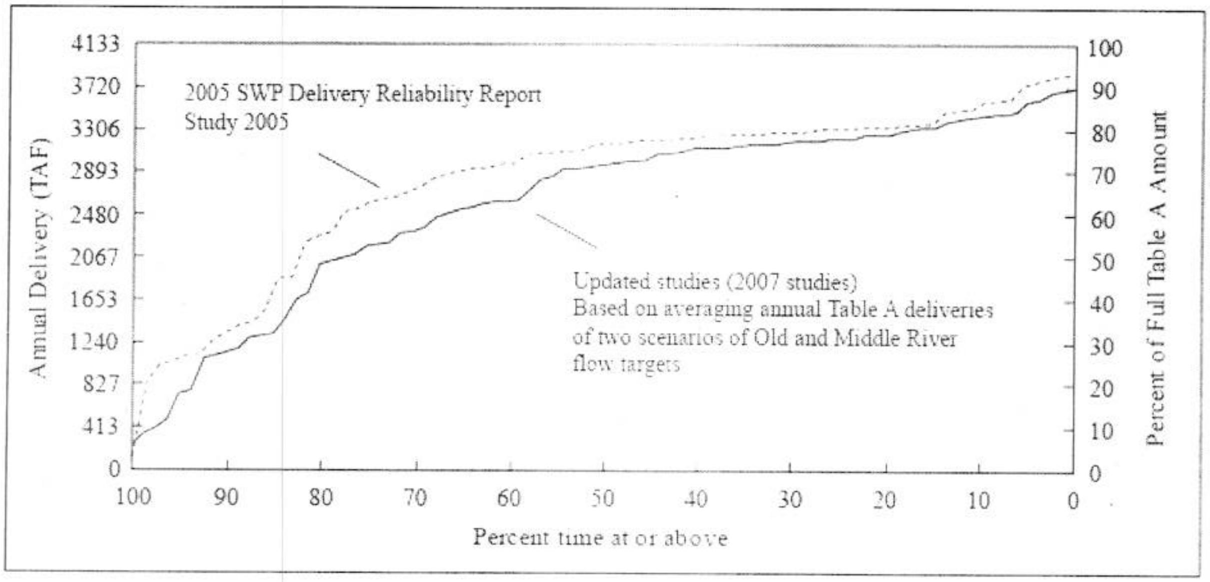

Figure 6-1 SWP Delta Table A delivery probability under Current Conditions

Figure 6-1 shows that under Current Conditions, for probabilities of exceedence above 40%, updated annual Table A deliveries can be 250 to 500 taf less than the earlier estimates. Annual Table A deliveries associated with exceedences below 40% are much less different than the 2005 study. Table 6-10 contains the values for SWP Delta deliveries corresponding to 25%, 50%, and 75% exceedence. The information in Table 6-10 can be stated as follows:

For any given year,

- There is a 25% chance that SWP deliveries will be at or above 3218 taf.
- There is an equal chance that SWP deliveries will be above or below 2976 taf.
- There is 75% chance that SWP deliveries will be above 2168 taf. Another way to state this is that there is a 25% chance that deliveries will be below this value.

Table 6-10 Highlighted SWP Table A delivery percent exceedence values under Current Conditions

Percent Exceedence	Annual SWP Table A Delivery (taf)		Reduction in delivery in updated studies compared to 2005 report (taf)
	2005 SWP Reliability Report Study 2005	Update with 2007 studies[1]	
25	3323	3218	105 (3%)
50	3173	2976	197 (6%)
75	2588	2168	420 (16%)

1/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3

Impact on total SWP Deliveries under Current Conditions Due to Flow Restrictions to Protect Delta Smelt

As previously discussed, the updated estimates of current SWP deliveries in this report incorporate effects on SWP deliveries caused by new restrictions in Old and Middle River flows ordered by the Court in December 2007. Tables 6-4, 6-5, 6-7, and 6-8 indicate that both Table A and Article 21 deliveries under the updated studies tend to be less overall and in particular during dry periods compared to the results presented in the previous 2005 report. This section further characterizes the change in combined Table A and Article 21 SWP deliveries due to the federal court order.

For the updated delivery estimates, CalSim II simulations were run assuming a lower level and a higher level of flow restrictions to give a range of potential SWP water delivery estimates. The lower- and higher-level restrictions are significantly different during February 21 through April 14 and May 16 through June 30. The specific rules for these flows are contained in Table 6-3. For presentation of combined SWP deliveries, annual Table A and Article 21 deliveries from the two simulations are averaged.

Figures 6-2 and 6-3 show the distribution of changes in total annual SWP deliveries between updated estimates and estimates from the 2005 report over the common 1922 through 1994 simulation period. Figure 6-2 shows the distribution of changes in total annual delivery in terms of thousand acre-feet and frequency of occurrence while Figure 6-3 shows the distribution of changes in terms of percent change from the 2005 report estimates and frequency of occurrence. Any differences in SWP deliveries are nearly entirely due to the new flow restrictions for delta smelt in the updated studies. The total annual SWP deliveries which are used to generate Figures 6-2 and 6-3 are presented in Table B-22.

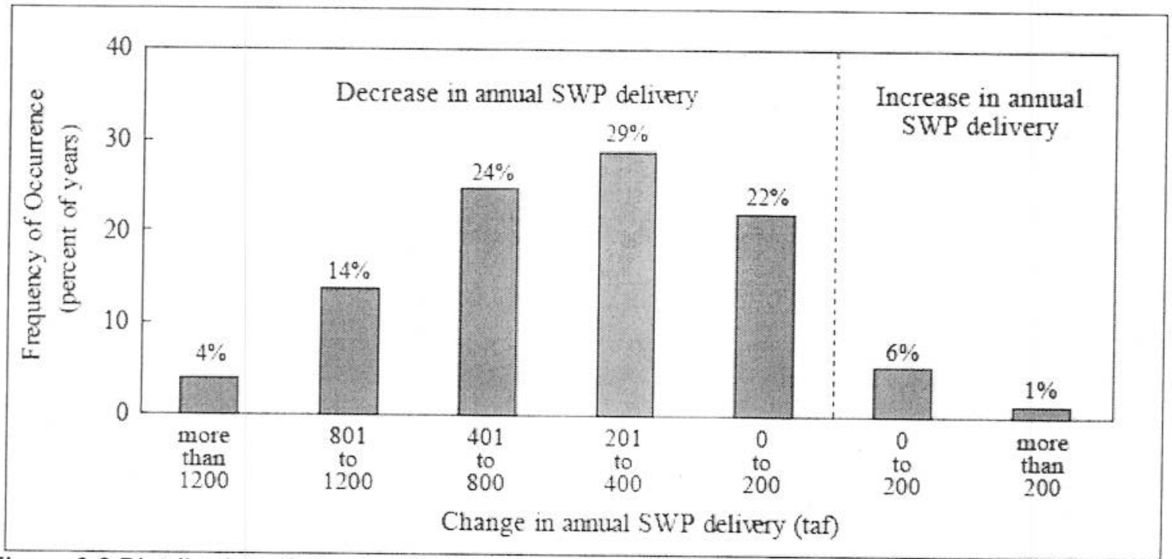

Figure 6-2 Distribution of changes in total annual SWP deliveries under Current Conditions due to implementation of flow restrictions to protect delta smelt

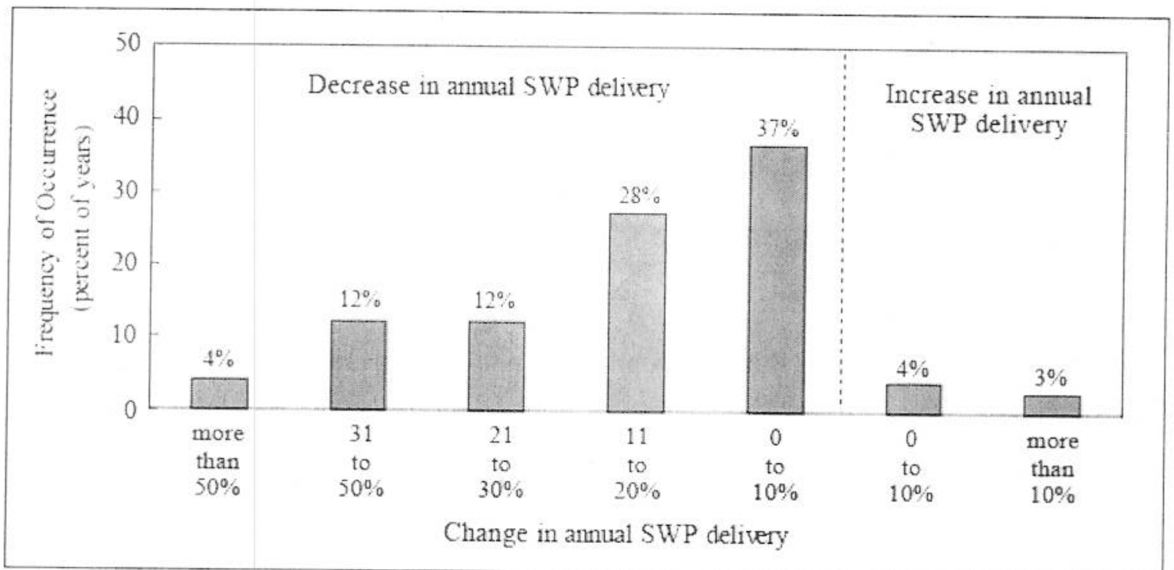

Figure 6-3 Distribution of percent changes in total annual SWP deliveries under Current Conditions due to implementation of flow restrictions to protect delta smelt

Figures 6-2 and 6-3 show that out of the 73 years of simulation (1922-1994), total annual SWP deliveries decrease 93% of the time under the updated estimates. Annual deliveries decrease from 0 to 400 taf over 50% of the time and from 401 to 1200 taf 38% of the time. In terms of percent decrease in deliveries, total annual SWP deliveries decrease more than 30% 16 percent of the time.

Table 6-7 shows that, on average, Article 21 delivery is about 175 taf less under the 2007 study than under the 2005 study. When this is combined with the difference in average Table A delivery projections presented in Table 6-4, the difference in total average SWP delivery is about 400 taf, for an overall decrease of about 13% in delivery capability from the 2005 to the 2007 study.

Table B-17 (cont.) SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario GFDL with A2 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Art. 21 Deliveries GFDL-A2 (taf)
		No Climate Change (taf)	GFDL A2 emissions (taf)	Interpolated GFDL-A2[2] (taf)	No Climate Change (taf)	GFDL A2 emissions (taf)	Interpolated GFDL-A2[2] (taf)	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	124	90	62	95	77	84
1970	1,408	444	31	252	294	0	157	204
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	30	14	0	0	0	7
1978	652	106	300	196	0	200	93	145
1979	1,408	0	0	0	0	0	0	0
1980	400	131	155	142	63	97	78	110
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	371	355	423
1985	1,156	0	0	0	0	0	0	0
1986	652	0	49	23	0	0	0	12
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	157	157	0	126	59	108
1998	652	0	0	0	0	0	0	0
1999	1,408	284	153	223	117	0	63	143
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	1,297	36	42	39	17	26	22	30
Min	400	0	0	0	0	0	0	0
Max	1,408	491	491	491	341	371	355	423

1/ See Table 6-3 2/ As described in Appendix B

Table B-18 SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario GFDL with B1 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1] No Climate Change (taf)	GFDL with B1 emissions (taf)	Interpolated GFDL-B1[2] (taf)	Article 21 Deliveries Under more restrictive flow targets[1] No Climate Change (taf)	GFDL with B1 emissions (taf)	Interpolated GFDL-B1[2] (taf)	Averaged Article 21 Deliveries GFDL-B1 (taf)
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	20	13	22	65	42	27
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	15	7	0	88	41	24
1933	1,408	87	0	47	0	0	0	23
1934	1,408	0	0	0	0	0	0	0
1935	1,408	0	142	66	0	225	105	85
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	112	52	0	0	0	26
1938	1,408	165	213	187	0	239	111	149
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	35	25	0	0	0	13
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	259	212	115	54	86	149
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	463	396	172	257	212	304
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	0	56	0	0	0	28
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	22	10	0	0	0	5

1/ See Table 6-3 2/ As described in Appendix B

Table B-18 (cont.) SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario GFDL with B1 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1] No Climate Change (taf)	GFDL B1 emissions (taf)	Interpolated GFDL-B1[2] (taf)	Article 21 Deliveries Under more restrictive flow targets[1] No Climate Change (taf)	GFDL B1 emissions (taf)	Interpolated GFDL-B1[2] (taf)	Averaged Art. 21 Deliveries GFDL-B1 (taf)
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	144	100	62	144	100	100
1970	1,408	444	43	257	294	0	157	207
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	247	171	0	54	25	98
1979	1,408	0	0	0	0	0	0	0
1980	400	131	174	151	63	168	112	131
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	326	334	413
1985	1,156	0	0	0	0	0	0	0
1986	652	0	54	25	0	0	0	13
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	229	191	0	115	53	122
1998	652	0	0	0	0	0	0	0
1999	1,408	284	332	306	117	0	63	184
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	1,297	36	39	38	17	24	20	29
Min	400	0	0	0	0	0	0	0
Max	1,408	491	491	491	341	326	334	413

1/ See Table 6-3 2/ As described in Appendix B

Table B-19 SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario PCM with A2 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Article 21 Deliveries PCM-A2 (taf)
		No Climate Change (taf)	PCM with A2 emissions (taf)	Interpolated PCM-A2[2] (taf)	No Climate Change (taf)	PCM with A2 emissions (taf)	Interpolated PCM-A2[2] (taf)	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	189	91	22	276	140	116
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	80	37	0	0	0	19
1933	1,408	87	270	172	0	0	0	86
1934	1,408	0	59	28	0	0	0	14
1935	1,408	0	160	75	0	125	58	66
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	133	62	0	0	0	31
1938	1,408	165	320	237	0	282	131	184
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	117	63	0	0	0	32
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	63	29	15
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	245	205	115	283	193	199
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	455	392	172	268	217	304
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	82	94	0	0	0	47
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	46	21	0	0	0	11

1/ See Table 6-3 2/ As described in Appendix B

Table B-19 (cont.) SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario PCM with A2 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Art. 21 Deliveries PCM-A2 (taf)
		No Climate Change (taf)	PCM with A2 emissions (taf)	Interpolated PCM-A2[2] (taf)	No Climate Change (taf)	PCM with A2 emissions (taf)	Interpolated PCM-A2[2] (taf)	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	61	61	62	61	62	61
1970	1,408	444	279	367	294	114	210	289
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	300	196	0	200	93	145
1979	1,408	0	0	0	0	0	0	0
1980	400	131	100	116	63	60	61	89
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	341	341	416
1985	1,156	0	0	0	0	0	0	0
1986	652	0	49	23	0	0	0	11
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	195	175	0	0	0	87
1998	652	0	0	0	0	0	0	0
1999	1,408	284	295	289	117	40	81	185
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	1,297	36	51	43	17	29	23	33
Min	400	0	0	0	0	0	0	0
Max	1,408	491	491	491	341	341	341	416

1/ See Table 6-3 2/ As described in Appendix B

Table B-20 SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario PCM with B1 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Article 21 Deliveries PCM-B1 (taf)
		No Climate Change (taf)	PCM with B1 emissions (taf)	Interpolated PCM-B1[2] (taf)	No Climate Change (taf)	PCM with B1 emissions (taf)	Interpolated PCM-B1[2] (taf)	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	48	25	22	29	25	25
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	0	0	0	0	0	0
1933	1,408	87	104	95	0	0	0	47
1934	1,408	0	0	0	0	0	0	0
1935	1,408	0	0	0	0	0	0	0
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	0	0	0	0	0	0
1938	1,408	165	0	88	0	0	0	44
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	49	32	0	0	0	16
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	168	169	115	0	61	115
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	325	331	172	176	174	253
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	122	113	0	0	0	57
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	0	0	0	0	0	0

1/ See Table 6-3 2/ As described in Appendix B

Table B-20 (cont.) SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario PCM with B1 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Art. 21 Deliveries PCM-B1 (taf)
		No Climate Change (taf)	PCM with B1 emissions (taf)	Interpolated PCM-B1[2] (taf)	No Climate Change (taf)	PCM with B1 emissions (taf)	Interpolated PCM-B1[2] (taf)	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	75	67	62	62	62	65
1970	1,408	444	424	435	294	274	285	360
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	54	82	0	0	0	41
1979	1,408	0	0	0	0	0	0	0
1980	400	131	125	128	63	87	74	101
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	340	340	241	239	240	290
1984	1,408	491	491	491	341	341	341	416
1985	1,156	0	0	0	0	0	0	0
1986	652	0	0	0	0	0	0	0
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	50	44	0	0	0	22
1997	1,156	158	255	203	0	0	0	102
1998	652	0	0	0	0	0	0	0
1999	1,408	284	310	296	117	115	116	206
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	1,297	36	36	36	17	16	17	26
Min	400	0	0	0	0	0	0	0
Max	1,408	491	491	491	341	341	341	416

1/ See Table 6-3 2/ As described in Appendix B

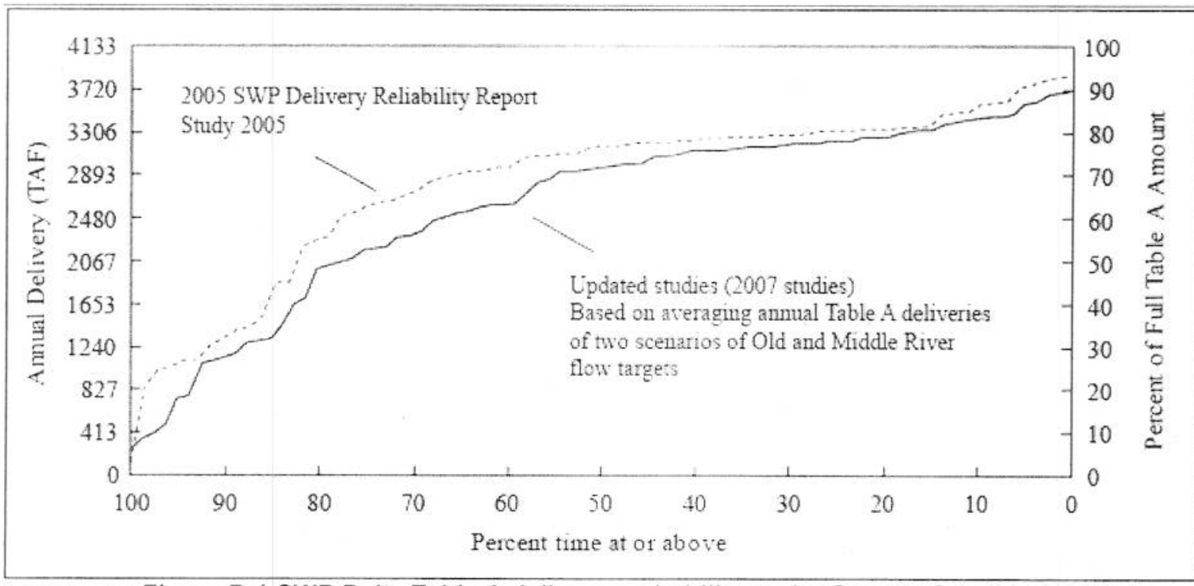

Figure B-1 SWP Delta Table A delivery probability under Current Conditions

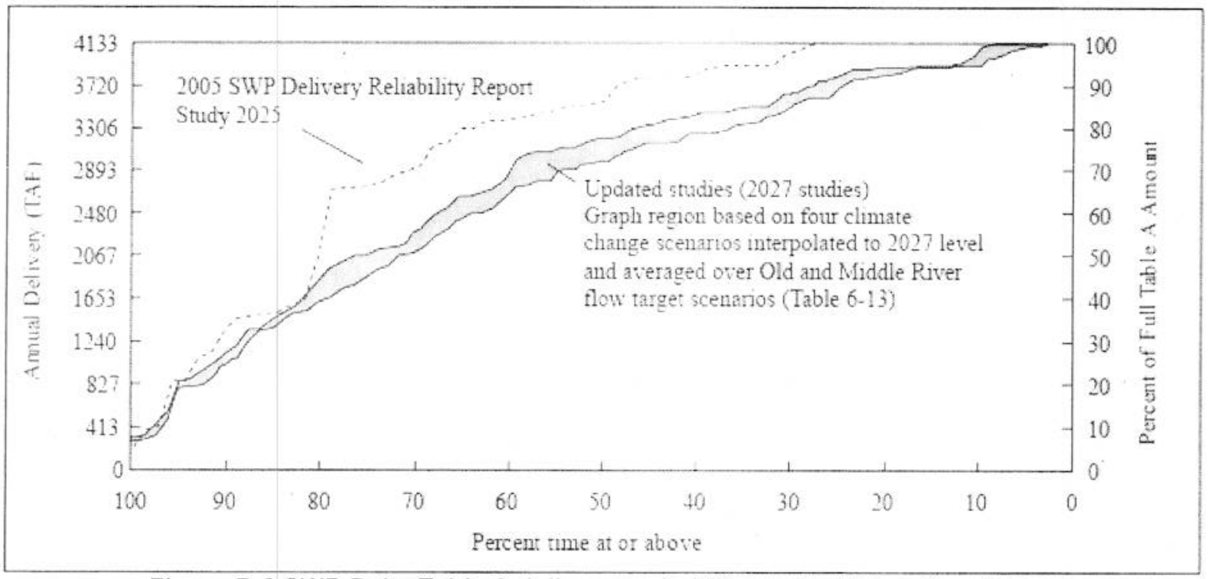

Figure B-2 SWP Delta Table A delivery probability under Future Conditions

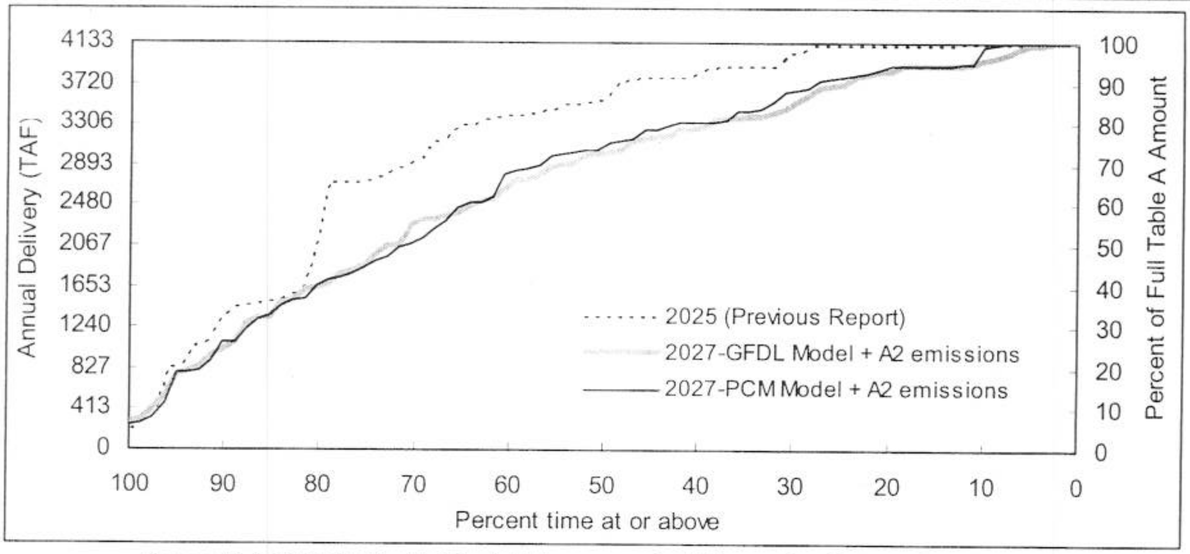

Figure B-3 SWP Delta Table A delivery probability under Future Conditions for climate change scenarios with A2 emissions

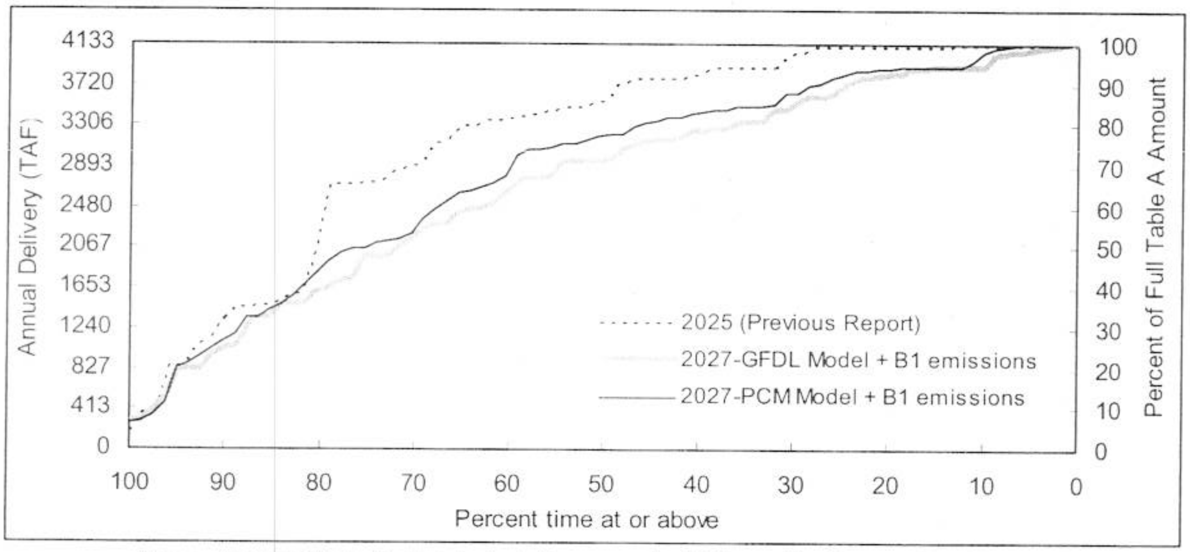

Figure B-4 SWP Delta Table A delivery probability under Future Conditions for climate change scenarios with B1 emissions

Table B-21 Highlighted SWP Table A delivery percent exceedence values under Current and Future Conditions

	Exceedence values (taf)		
	25%	50%	75%
2005 SWP Reliability Report			
Current (2005)	3323	3173	2588
Future (2025)	4133	3565	2738
Updated studies			
Current (2007)	3218	2976	2168
Future (2027)[1]			
GFDL+A2	3703	3017	1883
GFDL+B1	3686	2967	1966
PCM+A2	3782	3084	1860
PCM+B1	3813	3205	2077

1/ Based upon SWP Table A deliveries that have been interpolated between the "no climate change" scenario and the climate change scenarios determined by climate change model (GFDL or PCM) and greenhouse gas emissions scenario (A2 or B1). SWP Table A deliveries for two scenarios of Old and Middle River flow targets were then averaged.

Table B-22 Comparing total SWP deliveries under Current Conditions from updated studies to deliveries from 2005 Report

Year	Total SWP Deliveries (Table A + Article 21) study 2005 (2005 Report) (taf)	study 2007[1] (updated) (taf)	Change in total SWP deliveries (taf)	Year	Total SWP Deliveries (Table A + Article 21) study 2005 (2005 Report) (taf)	study 2007[1] (updated) (taf)	Change in total SWP deliveries (taf)
1922	3,847	3,674	-173	1963	4,020	3,406	-614
1923	3,358	3,159	-199	1964	3,323	2,211	-1,113
1924	1,244	400	-844	1965	3,236	2,861	-376
1925	1,870	1,644	-226	1966	3,800	3,265	-534
1926	3,035	2,186	-849	1967	3,870	3,125	-745
1927	4,058	3,699	-359	1968	3,881	3,379	-501
1928	3,518	2,059	-1,459	1969	2,907	2,825	-82
1929	1,108	753	-355	1970	3,809	3,717	-92
1930	2,972	2,028	-944	1971	3,341	3,317	-24
1931	1,018	1,105	88	1972	3,756	1,707	-2,049
1932	1,649	1,305	-344	1973	3,476	3,085	-390
1933	1,842	2,019	177	1974	4,038	3,232	-806
1934	1,746	1,315	-432	1975	4,132	3,391	-741
1935	3,998	3,334	-663	1976	3,455	2,609	-846
1936	3,573	3,124	-449	1977	159	243	84
1937	3,442	3,219	-223	1978	3,903	3,699	-203
1938	4,058	3,982	-76	1979	3,661	3,128	-533
1939	3,612	3,348	-264	1980	2,847	2,898	52
1940	3,374	3,165	-209	1981	3,904	3,128	-777
1941	2,773	2,576	-197	1982	3,691	3,430	-260
1942	4,086	3,665	-420	1983	2,898	2,897	-1
1943	3,727	3,667	-60	1984	3,318	3,687	370
1944	3,091	2,930	-161	1985	3,214	3,198	-16
1945	3,460	3,085	-375	1986	2,417	2,321	-97
1946	3,464	3,199	-265	1987	3,442	2,825	-617
1947	3,292	2,314	-978	1988	856	477	-380
1948	2,942	2,609	-333	1989	3,174	3,130	-43
1949	2,264	1,271	-993	1990	1,099	360	-739
1950	3,199	2,462	-737	1991	1,052	729	-323
1951	3,886	3,718	-167	1992	1,426	1,087	-339
1952	2,863	2,685	-178	1993	4,007	3,711	-296
1953	3,836	3,413	-423	1994	3,306	2,105	-1,201
1954	3,817	3,201	-616	1995		3,061	
1955	2,207	1,137	-1,070	1996		3,845	
1956	3,911	3,838	-73	1997		3,443	
1957	3,492	2,545	-947	1998		3,147	
1958	4,086	3,388	-698	1999		3,816	
1959	3,846	3,511	-335	2000		3,451	
1960	1,865	1,460	-405	2001		1,164	
1961	2,756	2,357	-399	2002		2,162	
1962	3,262	2,962	-300	2003		2,943	

1/ Average of the two scenarios of Old and Middle River flow targets described in Table 6-3.

Table B-23 Comparing total SWP deliveries under Future Conditions from updated studies to deliveries from 2005 Report

Year	Total SWP Deliveries (Table A + Article 21)					Change in total SWP deliveries from 2025 Study (2005 Report)			
	study 2025	Updated Studies[1]							
	(2005 Report) (taf)	GFDL A2 (taf)	GFDL B1 (taf)	PCM A2 (taf)	PCM B1 (taf)	GFDL A2 (taf)	GFDL B1 (taf)	PCM A2 (taf)	PCM B1 (taf)
1922	4,154	3,848	3,810	3,834	3,869	-306	-344	-319	-284
1923	4,133	2,649	2,631	2,848	3,062	-1,484	-1,502	-1,285	-1,071
1924	382	427	406	317	261	45	24	-64	-121
1925	1,681	1,545	1,537	1,636	1,719	-136	-145	-45	38
1926	3,000	2,074	1,975	1,956	2,111	-926	-1,025	-1,044	-889
1927	4,434	3,844	3,820	3,922	3,885	-590	-614	-512	-549
1928	3,379	1,981	1,967	1,910	2,054	-1,398	-1,412	-1,469	-1,326
1929	1,118	767	810	790	837	-351	-308	-327	-281
1930	2,879	2,343	2,150	2,085	2,154	-536	-729	-794	-725
1931	1,072	1,008	1,036	1,089	1,110	-63	-36	17	38
1932	1,684	1,389	1,372	1,348	1,436	-295	-311	-335	-248
1933	1,884	1,665	1,634	1,799	2,189	-219	-249	-85	306
1934	1,713	1,351	1,349	1,366	1,357	-362	-364	-348	-357
1935	4,279	3,343	3,353	3,510	3,452	-936	-927	-769	-827
1936	3,729	3,428	3,146	3,334	3,344	-301	-584	-396	-385
1937	3,439	3,042	2,988	3,184	3,465	-397	-452	-255	26
1938	4,333	4,332	4,282	4,317	4,177	-1	-51	-16	-156
1939	3,450	2,887	2,945	3,119	3,224	-564	-505	-331	-226
1940	4,230	3,456	3,357	3,454	3,500	-774	-873	-775	-729
1941	3,908	3,791	3,768	3,859	3,873	-117	-140	-49	-35
1942	4,256	3,664	3,613	3,758	3,890	-591	-643	-498	-366
1943	4,274	3,596	3,612	3,695	3,653	-678	-662	-579	-621
1944	3,542	2,338	2,305	2,238	2,723	-1,203	-1,236	-1,303	-819
1945	4,007	3,375	3,152	3,645	3,511	-632	-854	-362	-495
1946	3,828	3,395	3,471	3,283	3,509	-433	-358	-545	-319
1947	2,771	1,775	1,729	1,672	1,806	-995	-1,042	-1,099	-965
1948	2,940	2,745	2,773	2,881	3,082	-194	-167	-58	142
1949	2,025	1,276	1,241	1,231	1,356	-749	-784	-794	-669
1950	3,400	2,471	2,417	2,446	2,637	-929	-983	-954	-763
1951	4,385	4,234	4,211	4,332	4,168	-150	-173	-53	-217
1952	3,912	3,900	3,892	3,907	3,907	-12	-20	-5	-5
1953	4,429	3,252	3,260	3,343	3,516	-1,177	-1,169	-1,086	-913
1954	4,133	2,867	2,949	3,007	3,120	-1,266	-1,184	-1,126	-1,013
1955	1,505	952	946	902	1,024	-553	-559	-603	-481
1956	4,485	4,440	4,437	4,437	4,386	-45	-49	-48	-99
1957	3,565	2,068	2,067	2,052	2,210	-1,498	-1,498	-1,513	-1,356
1958	4,362	4,044	4,065	4,181	4,190	-318	-297	-182	-173
1959	3,893	2,731	2,733	2,801	3,073	-1,163	-1,160	-1,092	-821
1960	1,607	1,621	1,468	1,537	1,576	14	-138	-70	-31
1961	3,011	2,371	2,476	2,515	2,529	-640	-535	-496	-482
1962	3,312	3,012	2,973	3,044	3,212	-300	-339	-267	-100

1/ Result of first interpolating annual deliveries as described in Appendix B then averaging two scenarios two scenarios of Old and Middle River flow targets described in Table 6-3.

Table B-23 (cont.) Comparing total SWP deliveries under Future Conditions from updated studies to deliveries from 2005 Report

Year	Total SWP Deliveries (Table A + Article 21) study 2025 (2005 Report) (taf)	Updated Studies[1] GFDL A2 (taf)	GFDL B1 (taf)	PCM A2 (taf)	PCM B1 (taf)	Change in Total SWP Deliveries from 2005 Report (2025 Study) GFDL A2 (taf)	GFDL B1 (taf)	PCM A2 (taf)	PCM B1 (taf)
1963	4,294	3,387	3,467	3,453	3,337	-908	-827	-841	-958
1964	2,889	1,810	1,766	1,739	2,013	-1,078	-1,123	-1,149	-875
1965	3,512	3,216	3,177	3,145	3,116	-296	-335	-366	-396
1966	4,311	3,137	3,099	3,251	3,431	-1,175	-1,212	-1,061	-881
1967	4,290	4,115	4,085	4,109	4,095	-175	-205	-181	-195
1968	4,262	2,525	2,523	2,555	2,676	-1,737	-1,739	-1,707	-1,586
1969	3,973	3,987	4,003	3,964	3,968	14	30	-8	-5
1970	4,615	4,188	4,221	4,422	4,493	-427	-394	-193	-123
1971	4,133	3,344	3,361	3,337	3,397	-789	-772	-796	-736
1972	2,721	1,491	1,491	1,446	1,492	-1,229	-1,230	-1,275	-1,229
1973	4,291	3,538	3,547	3,665	3,711	-753	-744	-625	-580
1974	4,202	3,965	3,835	3,926	3,962	-238	-367	-276	-241
1975	4,267	3,178	3,156	3,323	3,458	-1,089	-1,111	-944	-809
1976	3,137	1,850	1,965	1,843	1,929	-1,287	-1,172	-1,293	-1,208
1977	187	300	287	273	291	113	100	86	104
1978	4,202	4,049	4,003	4,049	3,946	-153	-199	-154	-257
1979	3,917	2,990	2,794	3,049	3,197	-927	-1,122	-868	-719
1980	3,599	3,807	3,843	3,858	3,885	208	244	259	286
1981	3,868	2,536	2,453	2,515	2,644	-1,331	-1,415	-1,353	-1,224
1982	4,304	4,133	4,133	4,133	4,133	-171	-171	-171	-171
1983	4,266	4,170	4,170	4,170	4,193	-96	-96	-96	-73
1984	4,623	4,528	4,501	4,549	4,549	-95	-122	-74	-74
1985	3,413	2,797	2,778	2,836	3,163	-616	-635	-577	-250
1986	2,941	2,914	2,938	2,992	2,805	-27	-2	51	-136
1987	3,490	2,400	2,313	2,320	2,465	-1,090	-1,177	-1,170	-1,025
1988	423	552	535	486	468	130	112	64	46
1989	3,604	3,153	3,250	3,324	3,387	-452	-354	-280	-218
1990	855	314	285	255	339	-541	-571	-601	-516
1991	850	799	807	783	870	-51	-43	-68	20
1992	1,563	1,099	1,065	1,092	1,183	-463	-497	-471	-379
1993	4,388	3,801	3,781	3,787	3,732	-587	-606	-601	-656
1994	3,153	1,675	1,650	1,776	2,066	-1,479	-1,504	-1,377	-1,088
1995		3,903	3,903	3,903	3,903				
1996		3,718	3,610	3,820	3,847				
1997		3,380	3,398	3,337	3,393				
1998		3,908	3,908	3,908	3,908				
1999		4,060	4,064	4,277	4,329				
2000		3,373	3,332	3,537	3,636				
2001		850	819	804	949				
2002		2,281	2,250	2,137	2,355				
2003		3,023	3,061	3,030	3,011				

1/ Result of first interpolating annual deliveries as described in Appendix B then averaging two scenarios two scenarios of Old and Middle River flow targets described in Table 6-3.

Appendix C. State Water Project Table A Amounts

The contracts between the Department of Water Resources and the 29 State Water Project water contractors define the terms and conditions governing the water delivery and cost repayment for the SWP. Table A is an exhibit to these contracts. Comprehension of Table A is important in understanding the information in this report. To understand the table, it is necessary to understand how the contracts work.

All water-supply related costs of the SWP are paid by the contractors, and Table A serves as a basis for allocating some of the costs among the contractors. In addition, Table A plays a key role in the annual allocation of available supply among contractors. When the SWP was being planned, the amount of water projected to be available for delivery to the contractors was 4.2 million acre-feet (maf) per year. This was referred to as the minimum project yield, and it was recognized that in some years the project would be unable to deliver that amount and in other years project supply could exceed that amount. The 4.2 maf number was used as the basis for apportioning available supply to each contractor and as a factor in calculating each contractor's share of the project's costs. This apportionment is accomplished by Table A in each contract. Table A lists by year and acre-feet the portion of the 4.2 maf deliverable to each contractor. Other contract provisions permit changes to an individual contractor's Table A under special circumstances. The total of the maximums in all the contracts now equals 4.173 maf.

A copy of the consolidated Table A from all the contracts follows this explanation. The amounts listed in Table A cannot be viewed as an indication of the SWP water delivery reliability, nor should these amounts be used to support an expectation that a certain amount of water will be delivered to a contractor in any particular time span. Table A is simply a tool for apportioning available supply and cost obligations under the contract. In this report, reference to "Table A amounts" means the amounts listed in Table A. Contractors also receive other classifications of water from the project, as distinguished from Table A (for example, Article 21 water, and turnback pool water). These other contract provisions are discussed in Appendix D.

Table C-1 Maximum annual SWP Table A amounts

SWP Contractors	Maximum Table A	SWP Contractors	Maximum Table A
Delivered from the Delta		**Southern California**	
North Bay		Antelope Valley-East Kern WA	141,400
Napa County FC&WCD	29,025	Castaic Lake WA	95,200
Solano County WA	47,756	Coachella Valley WD	121,100
Subtotal	**76,781**	Crestline-Lake Arrowhead WA	5,800
		Desert WA	50,000
South Bay		Littlerock Creek ID	2,300
Alameda County FC&WCD, Zone 7	80,619	Mojave WA	75,800
Alameda County WD	42,000	Metropolitan WDSC	1,911,500
Santa Clara Valley WD	100,000	Palmdale WD	21,300
Subtotal	**222,619**	San Bernardino Valley MWD	102,600
		San Gabriel Valley MWD	28,800
San Joaquin Valley		San Gorgonio Pass WA	17,300
Oak Flat WD	5,700	Ventura County FCD	20,000
County of Kings	9,305	**Subtotal**	**2,593,100**
Dudley Ridge WD	57,343		
Empire West Side ID	3,000	**Delta Subtotal**	**4,132,986**
Kern County WA	998,730		
Tulare Lake Basin WSD	95,922	**Feather River**	
Subtotal	**1,170,000**	County of Butte	27,500
		Plumas County FC&WCD	2,700
Central Coastal		City of Yuba City	9,600
San Luis Obispo County FC&WCD	25,000	**Subtotal**	**39,800**
Santa Barbara County FC&WCD	45,486		
Subtotal	**70,486**	**Grand Total**	**4,172,786**

Appendix D. Recent State Water Project Deliveries

SWP Contract Water Types

The State Water Project contracts define several classifications of water available for delivery to contractors under specific circumstances. All classifications are considered "project" water. Many contractors make frequent use of these additional water types to increase or decrease the amount available to them under Table A.

Table A Water

Each contract's Table A is the amount in acre-feet that is used to determine the portion of available supply to be delivered to that contractor. Table A water is water delivered according to this apportionment methodology and is given first priority for delivery.

Article 21 Water

Article 21 of the contracts permits delivery of water excess to delivery of Table A and some other water types to those contractors requesting it. It is available under specific conditions discussed in Chapter 4. Article 21 water is apportioned to those contractors requesting it in the same proportion as their Table A.

Turnback Pool Water

Contractors may choose to offer their allocated Table A water excess to their needs to other contractors through two pools in February and March. Contributing contractors receive a reduction in charges, and taking contractors pay extra.

Carryover Water

Pursuant to the long-term water supply contracts, the Department of Water Resources (DWR) has offered contractors the opportunity to carry over a portion of their allocated water approved for delivery in the current year for delivery during the next year. The carryover program was designed to encourage the most effective and beneficial use of water and to avoid obligating the contractors to use or lose the water by December 31 of each year. The water supply contracts state the criteria of carrying over Table A water from one year to the next. Normally, carryover water is water that has been exported during the year, has not been delivered to the contractor during that year, and has remained stored in the SWP share of San Luis Reservoir to be delivered during the following year. Storage for carryover water no longer becomes available to the contractors if it interferes with storage of SWP water for project needs.

Updated Historical Deliveries

The tables in this appendix list annual historical deliveries by various water classifications for each contractor for 1997 through 2006. Similar delivery tables for years 1995 through 2004 are included in the *State Water Project Delivery Reliability Report 2005*. Amounts listed for 2004 are slightly different due to accounting adjustments made by DWR's State Water Project Analysis Office.

Table D-1 Historical State Water Project deliveries: 1997

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	185				185
Plumas County FC&WCD	231				231
City of Yuba City	1,005				1,005
Napa County FC&WCD	4,341				4,341
Solano County WA	35,530				35,530
Alameda County FC&WCD, Zone 7	27,522				27,522
Alameda County WD	24,063				24,063
Santa Clara Valley WD	95,601				95,601
Oak Flat WD	5,238				5,238
Dudley Ridge WD	51,623	7,141	12,544		71,308
Kern County WA	1,092,543	10,264			1,102,807
Tulare Lake Basin WSD	21,156	1,213			22,369
San Luis Obispo County FC&WCD	1,199				1,199
Santa Barbara County FC&WCD	7,439				7,439
Antelope Valley-East Kern WA	61,752	641			62,393
Castaic Lake WA (+Rch 31A, 5 & 7)	27,712				27,712
Coachella Valley WD	23,100		35,000		58,100
Crestline-Lake Arrowhead WA	651				651
Desert WA	38,100		15,000		53,100
Littlerock Creeck ID	444				444
Mojave WA	10,374				10,374
Metropolitan WDSC	738,990				738,990
Palmdale WD	11,861				11,861
San Bernardino Valley MWD	9,654				9,654
San Gabriel Valley MWD	16,002	2,173			18,175
Ventura County FCD	1,850				1,850
Totals	**2,308,166**	**21,432**	**62,544**	**0**	**2,392,142**
Total South of Delta	**2,306,745**	**21,432**	**62,544**	**0**	**2,390,721**

Table D-2 Historical State Water Project deliveries: 1998

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	527				527
City of Yuba City	1,054				1,054
Napa County FC&WCD	5,359				5,359
Solano County WA	21,377	9,982		407	31,766
Alameda County FC&WCD, Zone 7	17,941				17,941
Alameda County WD	19,075				19,075
Santa Clara Valley WD	62,526			884	63,410
Oak Flat WD	4,401				4,401
County of Kings	3	12			15
Dudley Ridge WD	52,919	984		1,747	55,650
Empire West Side ID				542	542
Kern County WA	856,906			1,684	858,590
Tulare Lake Basin WSD	11,367	9,310			20,677
San Luis Obispo County FC&WCD	3,592				3,592
Santa Barbara County FC&WCD	18,618				18,618
Antelope Valley-East Kern WA	52,926				52,926
Castaic Lake WA (+Rch 31A, 5 & 7)	20,093				20,093
Coachella Valley WD	23,100		55,000		78,100
Crestline-Lake Arrowhead WA	187				187
Desert WA	38,100		20,000		58,100
Littlerock Creek ID	404				404
Mojave WA	3,925				3,925
Metropolitan WDSC	359,213			33,672	392,885
Palmdale WD	8,752				8,752
San Bernardino Valley MWD	1,878				1,878
San Gabriel Valley MWD	9,310				9,310
Ventura County FCD	1,850				1,850
Totals	**1,595,403**	**20,288**	**75,000**	**38,936**	**1,729,627**
Total South of Delta	**1,593,822**	**20,288**	**75,000**	**38,936**	**1,728,046**

Table D-3 Historical State Water Project deliveries: 1999

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	286				286
City of Yuba City	1,096				1,096
Napa County FC&WCD	4,550	754			5,304
Solano County WA	37,753				37,753
Alameda County FC&WCD, Zone 7	46,000	2,910			48,910
Alameda County WD	34,871	2,781			37,652
Santa Clara Valley WD	67,465	15,480			82,945
Oak Flat WD	4,871				4,871
County of Kings	4,000				4,000
Dudley Ridge WD	51,870	4,990	6,566		63,426
Empire West Side ID	3,000	176			3,176
Kern County WA	1,077,755	58,241	42,154		1,178,150
Tulare Lake Basin WSD	118,500	49,898	121,337		289,735
San Luis Obispo County FC&WCD	3,743				3,743
Santa Barbara County FC&WCD	20,137				20,137
Antelope Valley-East Kern WA	69,073				69,073
Castaic Lake WA (+Rch 31A, 5 & 7)	32,899				32,899
Coachella Valley WD	23,100		27,380		50,480
Crestline-Lake Arrowhead WA	1,132				1,132
Desert WA	38,100		20,000		58,100
Littlerock Creek ID	342				342
Mojave WA	5,144				5,144
Metropolitan WDSC	829,777	22,840			852,617
Palmdale WD	13,278				13,278
San Bernardino Valley MWD	12,874				12,874
San Gabriel Valley MWD	18,000				18,000
Ventura County FCD	1,850				1,850
Totals	**2,521,466**	**158,070**	**217,437**	**0**	**2,896,973**
Total South of Delta	**2,520,084**	**158,070**	**217,437**	**0**	**2,895,591**

Table D-4 Historical State Water Project deliveries: 2000

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	586				586
City of Yuba City	901				901
Napa County FC&WCD	3,136	297		1,525	4,958
Solano County WA	32,882	1,040		1,417	35,339
Alameda County FC&WCD, Zone 7	53,877	3,740			57,617
Alameda County WD	33,598	2,380			35,978
Santa Clara Valley WD	70,433	18,381		13,174	101,988
Oak Flat WD	4,494			14	4,508
County of Kings	3,600				3,600
Dudley Ridge WD	38,673	7,454	12,193	2,884	61,204
Empire West Side ID	1,271	528			1,799
Kern County WA	825,856	78,908	233,202	13,193	1,151,159
Tulare Lake Basin WSD	98,595	56,818	27,073	15,827	198,313
San Luis Obispo County FC&WCD	3,962				3,962
Santa Barbara County FC&WCD	22,741				22,741
Antelope Valley-East Kern WA	83,577				83,577
Castaic Lake WA (+Rch 31A, 5 & 7)	40,680				40,680
Coachella Valley WD	20,790	17,820	3,713		42,323
Crestline-Lake Arrowhead WA	1,194				1,194
Desert WA	34,290	17,820	6,124		58,234
Mojave WA	9,135				9,135
Metropolitan WDSC	1,273,729	103,124		169,529	1,546,382
Palmdale WD	8,221			839	9,060
San Bernardino Valley MWD	18,399				18,399
San Gabriel Valley MWD	14,000	475			14,475
Ventura County FCD	4,050				4,050
Totals	**2,702,670**	**308,785**	**282,305**	**218,402**	**3,512,162**
Total South of Delta	**2,701,183**	**308,785**	**282,305**	**218,402**	**3,510,675**

Table D-5 Historical State Water Project deliveries: 2001

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	513				513
City of Yuba City	1,065				1,065
Napa County FC&WCD	4,293	996	82	1,723	7,094
Solano County WA	17,756	2,304		1,021	21,081
Alameda County FC&WCD, Zone 7	22,307		308	5,990	28,605
Alameda County WD	13,695	10	107	4,192	18,004
Santa Clara Valley WD	35,689			12,233	47,922
Oak Flat WD	2,089		22	101	2,212
County of Kings	1,560				1,560
Dudley Ridge WD	18,467	933	347	6,815	26,562
Empire West Side ID		253		1,107	1,360
Kern County WA	363,204	23,233	6,502	92,052	484,991
Tulare Lake Basin WSD	40,830	8,755	769	7,889	58,243
San Luis Obispo County FC&WCD	4,184		99		4,283
Santa Barbara County FC&WCD	14,285	396	296		14,977
Antelope Valley-East Kern WA	45,071		899		45,970
Castaic Lake WA (+Rch 31A, 5 & 7)	30,471	850	618		31,939
Coachella Valley WD	9,009		91		9,100
Crestline-Lake Arrowhead WA	1,057				1,057
Desert WA	14,859		151		15,010
Mojave WA	4,433				4,433
Metropolitan WDSC	686,545	10,415	7,949	200,000	904,909
Palmdale WD	8,170			2,257	10,427
San Bernardino Valley MWD	26,488				26,488
San Gabriel Valley MWD	6,534				6,534
Ventura County FCD	1,850				1,850
Totals	**1,374,424**	**48,145**	**18,240**	**335,380**	**1,776,189**
Total South of Delta	**1,372,846**	**48,145**	**18,240**	**335,380**	**1,774,611**

Table D-7 Historical State Water Project deliveries: 2003

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	551				551
City of Yuba City	1,324				1,324
Napa County FC&WCD	6,026	376	180	1,055	7,637
Solano County WA	25,135	2,280		1,918	29,333
Alameda County FC&WCD, Zone 7	30,695		656	13,099	44,450
Alameda County WD	31,086		354	5,150	36,590
Santa Clara Valley WD	90,620	936	841	14,104	106,501
Oak Flat WD	4,059	19	48	140	4,266
County of Kings	3,600	58	34		3,692
Dudley Ridge WD	49,723	1,928	482	1,452	53,585
Empire West Side ID	1,074	175		187	1,436
Kern County WA	841,697	27,891	8,419	22,380	900,387
Tulare Lake Basin WSD	94,376	6,243	938	4,284	105,841
San Luis Obispo County FC&WCD	4,417	36			4,453
Santa Barbara County FC&WCD	24,312	339	43	2,274	26,968
Antelope Valley-East Kern WA	52,730		250	7,049	60,029
Castaic Lake WA (+Rch 31A, 5 & 7)	49,895	991	90	4,760	55,736
Coachella Valley WD	14,045	204	194		14,443
Crestline-Lake Arrowhead WA	1,563				1,563
Desert WA	23,168	330	321		23,819
Mojave WA	10,907			3,528	14,435
Metropolitan WDSC	1,550,356	17,622	16,920	134,845	1,719,743
Palmdale WD	9,701			1,846	11,547
San Bernardino Valley MWD	25,371	200		1,844	27,415
San Gabriel Valley MWD	13,034	200			13,234
San Gorgonio Pass WA	116				116
Ventura County FCD	5,000				5,000
Totals	**2,964,581**	**59,828**	**29,770**	**219,915**	**3,274,094**
Total South of Delta	**2,962,706**	**59,828**	**29,770**	**219,915**	**3,272,219**

Table D-10 Historical State Water Project deliveries: 2006

	Table A	Art. 21	Turnback	Carryover	Total
County of Butte	468				468
City of Yuba City	4,148	1,194			5,342
Napa County FC&WCD	7,312	300		172	7,784
Solano County WA	12,070	18,195		390	30,655
Alameda County FC&WCD, Zone 7	50,785		491	2,252	53,528
Alameda County WD		2,375	39,373	1,331	43,079
Santa Clara Valley WD	47,344	26,769		524	74,637
Oak Flat WD	4,118		107	17	4,242
County of Kings	8,991	366	173		9,530
Dudley Ridge WD	55,343	18,515	1,068		74,926
Empire West Side ID	1,500	1,124		658	3,282
Kern County WA	961,882	256,634	18,610	5,418	1,242,544
Tulare Lake Basin WSD	48,361	59,424	1,787		109,572
San Luis Obispo County FC&WCD	3,382	827			4,209
Santa Barbara County FC&WCD	19,255	4,020			23,275
Antelope Valley-East Kern WA	76,623			3,761	80,384
Castaic Lake WA (+Rch 31A, 5 & 7)	56,758	2,089		3,905	62,752
Coachella Valley WD	121,100				121,100
Crestline-Lake Arrowhead WA	257				257
Desert WA	50,000				50,000
Mojave WA	32,496			1,518	34,014
Metropolitan WDSC	1,103,538	238,478	11,638	136,424	1,490,078
Palmdale WD	10,374	1,653	130	335	12,492
San Bernardino Valley MWD	31,902			3,427	35,329
San Gabriel Valley MWD	13,524				13,524
San Gorgonio Pass WA	4,262				4,262
Ventura County FCD	1,850				1,850
Totals	**2,727,643**	**631,963**	**73,377**	**160,132**	**3,593,115**
Total South of Delta	**2,723,027**	**630,769**	**73,377**	**160,132**	**3,587,305**

Assessment of SWP Delivery Reliability under Future Conditions

Future Conditions refer to conditions which are assumed in effect in the year 2027. These conditions as described below include effects of climate change and the same Old and Middle River flow targets that are assumed under Current Conditions. Results from the CalSim II simulation for the 2005 SWP Delivery Reliability Report under 2025 future scenario (Study 2025) are presented throughout this section for comparison purposes. A detailed list of the study assumptions for this report is presented in Appendix A.

Availability of Source Water

DWR's 2006 report, *Progress on Incorporating Climate Change into Management of California's Water Resources*, evaluates possible future impact on California water supply through CalSim II simulations with hydrologic sequences which reflect different scenarios of climate change. The four climate change scenarios consist of two greenhouse gas emissions scenarios, A2 and B1, and two global climate models, the Geophysical Fluid Dynamic Lab model (GFDL) and the Parallel Climate model (PCM). The A2 emissions scenario assumes high growth in population, regional based economic growth, and slow technological changes, which results in significantly higher greenhouse gas emissions. The B1 scenario represents low growth in population, global based economic growth, and sustainable development that results in a low increase in greenhouse gas emissions. Both the GFDL model and PCM project future warming although the GFDL model indicates a greater warming trend than the PCM. These four scenarios are assumed for the analysis in this report in order to generate the 82-year hydrologic sequence. It should be noted that these scenarios, although focusing on potential water supply conditions in 2050, include the assumption that water use in the water supply basins is at a 2020 level of development, not a 2050 level of development. In this respect, the studies span assumed temporal points of reference. They are, however, the best available estimates for future SWP water deliveries.

Demand for Delta Water

The SWP contractors' Table A demands for deliveries from the Delta assumed for 2027 are shown in Table 6-11. The assumed demands for the studies were developed in discussions with SWP water contractors and stakeholders involved in the development of DWR's *Draft Environmental Impact Report (Draft EIR) for the Monterey Amendment to the State Water Project Contracts, including the Kern Water Bank Transfer and associated actions as part of a Settlement Agreement (Monterey Plus)*. Maximum and minimum Table A demand is shown because the demand is assumed to vary each year with the weather.

Table 6-11 SWP Table A demands from the Delta under Future Conditions

Study of Future Conditions	Average Demand		Maximum Demand		Minimum Demand	
	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]
2025 SWP Reliability Report, Study 2025	4110	99%	4133	100%	3898	94%
Update with 2027 studies	4111	99%	4133	100%	3935	95%
1/ 4,133 taf /year.						

SWP Article 21 demands for water under future (2027) conditions were the same as were assumed in the 2005 reliability report for the 2025 study (Table 6-12).

Table 6-12 Article 21 demands from the Delta under Future Conditions

Study of Future Conditions	Average Article 21 demand (taf) Dec-Mar	Apr-Nov	Total (taf)
2005 SWP Reliability Report, Study 2025	704	607	1311
Update with 2027 studies	699	598	1297

Ability to Convey Source Water to the Desired Point of Delivery

One of the most significant assumptions regarding SWP conveyance is that the rules and facilities related to Delta conveyance will remain at the status quo. That is, no new facilities are assumed to be in place to convey water through, around, or through and around the Delta. As noted in Chapter 3, there are several processes underway to identify modifications to the existing method of conveying water through the Delta to reduce the conflict between fishery concerns and water supply reliability. However, these programs are not at a stage where such changes can be used in this report. The CalSim II simulations for 2027 scenarios assume the current Delta water quality regulations (contained in the State Water Resources Control Board's Decision 1641) are in place as well as the flow restrictions for Old and Middle rivers set forth in the recent court-ordered interim action related to delta smelt. The studies evaluate a lower level and a higher level of flow restrictions to give a range of potential SWP water delivery estimates. The specific rules for these flows are contained in Table 6-3. The exports resulting from meeting Old and Middle River flow targets related to delta smelt are again assumed shared equally between the CVP and the SWP.

The simulation of Future Conditions in the 2005 report (study 2025) also assumed D-1641 Delta water quality requirements and combined SWP and CVP pumping restrictions according to the 2004 Long-Term Central Valley Project Operations Criteria and Plan. It did not assume the flow restrictions for Old and Middle rivers were in place.

To simulate the assumed 2027 conditions, a total of ten CalSim II simulations are needed: the two levels of flow restrictions combined with four climate change scenarios and a scenario assuming no climate change. SWP deliveries derived from these ten simulations were modified as explained below before being used to describe future conditions .

Presentation of CalSim II Results

For the purpose of describing SWP deliveries under Future Conditions in this chapter, the annual deliveries under the four scenarios of climate change simulated by CalSim II were adjusted to better estimate deliveries reflecting 2027 conditions. As previously mentioned, the climate change scenarios for Future Conditions assume projections of climate and hydrology for the year 2050. Currently, 2027 climate change projections are not available. In order to estimate SWP deliveries twenty years in the future with potential changes in climate, annual SWP deliveries were interpolated between deliveries from a CalSim II simulation of a particular climate change scenario under the low or high operation restrictions for Old and Middle River flows and deliveries from the corresponding CalSim II simulation which assumes no climate change. All CalSim II simulations for these future conditions assume a 2027 SWP demand level.

Each climate change scenario then consists of two sequences of modified (interpolated) SWP deliveries, one sequence for each of the two levels of Old and Middle River flow targets. For each climate change scenario, these two sequences of annual deliveries were then averaged to yield a single sequence designed to reflect a climate change projection to 2027 with an averaged Old and Middle River flow target operation. The following tables and graph of SWP Table A delivery probability are based on these four sequences of annual SWP deliveries. The annual SWP Table A and Article 21 deliveries for the ten simulations upon which the information in this section is based are presented in Appendix B.

SWP Table A Deliveries under Different Hydrologic Scenarios

Table 6-12 contains the average, maximum, and minimum estimates of Table A deliveries from the Delta under Future Conditions from study 2025 from the 2005 SWP reliability report and under updated 2027 assumptions. The deliveries under 2027 conditions are shown as a range to account for the four climate change scenarios. The estimated probabilities for a given amount of annual SWP delivery under Future Conditions are presented in Figure 6-4.

Table 6-13 shows that under the updated Future Conditions, average SWP delivery amounts may decrease from 8 to 11% of maximum Table A amounts compared to earlier estimates. Since SWP Table A demands are the same in the earlier and updated studies, this decrease in deliveries is primarily due to the incorporation of the Old and Middle River flow targets related to delta smelt reducing the amount of Delta water available for export by SWP and the assumed hydrologic changes associated with climate change. The estimate of minimum annual SWP Table A delivery for the updated study ranges from 6 to 7% of maximum Table A amounts.

Table 6-14 includes estimates of SWP Table A deliveries for a single-year and multi-year droughts. It also includes the average of the Table A deliveries for comparison purposes. Estimates of updated SWP deliveries under Current Conditions during dry periods can range 5% of maximum Table A (32% to 37% for 1931-1934). This is a range of almost 210 taf/year. With the period 1931-1934 being the exception, all other multi-year droughts show reduced deliveries. The reductions range from 2% to 13% of maximum Table A amounts, from 83 taf/yr to 540 taf/yr.

Table 6-13 SWP Table A delivery from the Delta under Future Conditions

Study of Future Conditions	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]
2005 SWP Reliability Report, Study 2025	3178	77%	4133	100%	187	5%
Update with 2027 studies[3]	2724 – 2850	66 – 69%	4133	100%	255 – 293	6 – 7%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-14 Average and dry period SWP Table A deliveries from the Delta under Future Conditions

Study of Future conditions	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Long-term Average[2]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Reliability Report, Study 2025	77%	5%	40%	33%	42%	38%
Update with 2027 studies[3]	66 – 69%	7%	26 – 27%	32 – 37%	33 – 35%	33 – 36%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-15 summarizes SWP Table A deliveries under an assumed repetition of historical wet periods under Future Conditions. As with drought years, the Eight River Index is used to identify wet years. The estimated deliveries for the updated Future Condition during wet periods do not generally range as much as those for the dry periods. The maximum range is 3% of maximum Table A for the 6-year and 10-year wet periods. This equates to a range of 120 taf/yr. Reductions in delivery amounts are significant for the 4-, 6-, and 10-year wet periods. For example, average annual SWP Table A deliveries decrease to a range of 86 to 87% of maximum Table A for the 1980-1983 period. The estimate for the 2025 study for this period is 93%. This is a reduction of 250 to 290 taf/yr.

Table 6-15 Average and wet period SWP Table A deliveries from the Delta under Future Conditions

Study of Future Conditions	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Long-term average[2]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Reliability Report, Study 2025	77%	95%	97%	93%	93%	89%
Update with 2027 studies[3]	66 – 69%	94%	97%	86 – 87%	84 – 87%	80 – 83%

1/ 4,133 taf/year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Article 21 Deliveries under Different Hydrologic Scenarios

Table 6-16 contains the average, maximum, and minimum SWP Article 21 deliveries over the 1922-1994 period for earlier studies and the 1922-2003 period for the updated simulations of Future Conditions. Comparing the estimates of SWP Article 21 deliveries, the updated estimates show less delivery amounts on average and for the maximum annual delivery over the simulation period. Estimated average Article 21 deliveries are 90 taf less under updated Future Conditions than was estimated in the 2005 SWP Delivery Reliability Report. Estimated maximum Article 21 delivery is reduced 120 to 130 taf.

Table 6-16 Annual SWP Article 21 delivery from the Delta under Future Conditions

Study of Future Conditions	Average delivery[1] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Reliability Report, Study 2025	120	550	0
Update with 2027 studies[2]	30	410 – 420	0

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-17 contains the estimates for Article 21 deliveries during historical dry periods. No Article 21 delivery is estimated for the lower range of the updated Future Conditions for any of the years. For the higher range, some Article 21 deliveries are shown for 1932 through 1934 and 1977. The availability of Article 21 deliveries during dry periods is greatly reduced in the analysis of the updated Future Condition.

Table 6-17 Average and dry year SWP Article 21 delivery under Future Conditions (taf per year)

Year	2005 SWP Reliability Report Study 2025	Update with 2027 studies[2]
1929	0	0
1930	140	0
1931	0	0
1932	110	0 – 40
1933	550	20 – 90
1934	240	0 – 10
1976	0	0
1977	0	0 – 10
1987	180	0
1988	0	0
1989	90	0
1990	0	0
1991	0	0
1992	100	0
Long-term Average[1]	120	30

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-18 shows updated and earlier estimates of Article 21 deliveries by year during the 1978-1987 wet period. The availability of Article 21 deliveries is also reduced for this wet period. The average Article 21 delivery for the 1978 - 1987 period under Future Conditions ranges from 90 to 100 taf/yr and for the 2025 study, it is 190 taf/yr.

Table 6-18 Average and wet year SWP Article 21 delivery under Future Conditions (taf per year)

Year	2005 SWP Reliability Report Study 2025	Update with 2027 studies[2]
1978	300	40 – 150
1979	140	0
1980	90	90 – 130
1981	70	0
1982	170	0
1983	360	270 – 290
1984	490	410 – 420
1985	0	0
1986	80	0 – 10
1987	180	0
1978-87 Average	190	90 – 100
Long-term Average[1]	120	30

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

SWP Table A Delivery Probability

The probability that a given level of SWP Table A amount will be delivered from the Delta is shown for Future Conditions in Figure 6-4. Results from both the 2025 study from the 2005 SWP Reliability Report and the updated 2027 studies are shown. Probabilities for 2027 conditions are shown as a shaded area to reflect the range in Table A deliveries resulting from the four climate change scenarios analyzed.

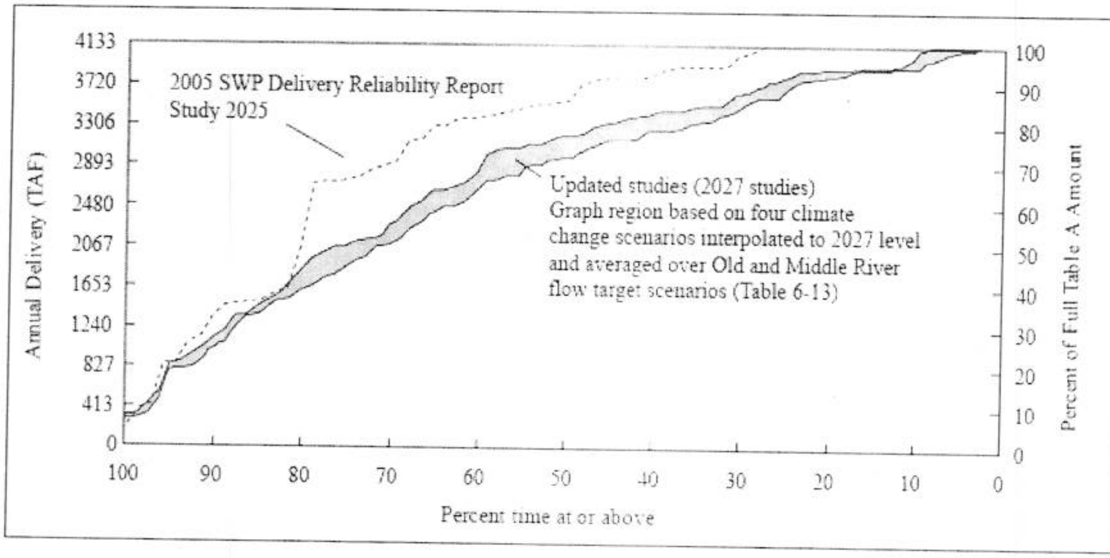

Figure 6-4 SWP Delta Table A delivery probability under Future Conditions

Figure 6-4 shows that under Future Conditions, for probabilities of exceedence under 80%, updated annual Table A deliveries can be significantly less than the earlier estimates. For example, given a 60% time at or above, an earlier estimate of about 3400 taf annually decreases to about 2670 taf to 2890 taf annually for the updated estimates. Displaying delivery probabilities as a shaded area on Figure 6-4 shows the impact of uncertainty on probabilities associated with a given future Table A delivery. The information upon which Figure 6-4 is based is contained in Tables B-12 through B-15 in Appendix B.

Table 6-19 presents the SWP Table A annual deliveries associated with 25, 50, and 75 percent exceedence from Figure 6-4. The information in this table can be stated as follows:

For any given year,

- There is 1 chance in 4 that SWP deliveries will be at or above the range of 3687 taf to 3815 taf.
- There is an equal chance that SWP deliveries will be above or below the range of 2967 taf to 3205 taf.
- There is 75% chance that SWP deliveries will be above the range of 1860 taf to 2077 taf. Another way to state this is that there is a 25% chance that deliveries will be below this range.

Table 6-19 Highlighted SWP Table A delivery percent exceedence values under Future Conditions

Percent Exceedence	Annual SWP Table A Delivery (taf)		Reduction in delivery in updated studies compared to 2005 report (taf)
	2005 SWP Reliability Report Study 2025	Update with 2027 studies[1]	
25	4133	3687 – 3815	318 – 446 (8 – 11%)
50	3565	2967 – 3205	360 – 598 (10 – 17%)
75	2738	1860 – 2077	661 – 878 (24 – 32%)

1/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Comparing Current and Future SWP Delivery Reliability

CalSim II simulation-based results presented earlier in this chapter compare updated delivery projections with those contained in the 2005 reliability report and generally show that deliveries are projected to be less than projected in the 2005 report due to adding flow restrictions for Old and Middle rivers set forth in the recent court-ordered interim action related to delta smelt and potential climate change scenarios. This section presents the same CalSim II simulation-based results in a way to facilitate comparing current reliability to future reliability. Results from the 2005 SWP Delivery Reliability Report are presented as a reference.

SWP Table A Deliveries under Different Hydrologic Scenarios

Tables 6-20, 6-21, and 6-22 contain summaries and highlights of estimated Table A deliveries from the Delta under Current and Future Conditions from the 2005 SWP Delivery Reliability Report and as derived from updated CalSim II simulations for this report. In the 2005 report, future SWP deliveries on average tended to increase over current deliveries. The updated estimates of future SWP deliveries also tend to increase compared to updated estimated current deliveries. An exception is for dry periods. The 2005 report indicated that future SWP Table A deliveries for dry periods would be approximately the same as for current dry periods. The updated estimates indicate that future SWP Table A deliveries under a 2-year drought condition (1976-1977) could be lower by as much as 8% of maximum Table A than under current conditions (Table 6-21).

Table 6-20 SWP Table A delivery from the Delta under Current and Future Conditions

	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]	taf /year	% maximum Table A[1]
2005 SWP Reliability Report						
Current (2005)	2818	68%	3848	93%	159	4%
Future (2025)	3178	77%	4133	100%	187	5%
Updated studies						
Current (2007)	2595	63%	3711	90%	243	6%
Future (2027)[3]	2724 – 2850	66 – 69%	4133	100%	255 – 293	6 – 7%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-21 Average and dry period SWP Table A deliveries from the Delta under Current and Future Conditions

	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Long-term Average[2]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Reliability Report						
Current (2005)	68%	4%	41%	32%	42%	37%
Future (2025)	77%	5%	40%	33%	42%	38%
Update studies						
Current (2007)	63%	6%	34%	35%	35%	34%
Future (2027)[3]	66 – 69%	7%	26 – 27%	32 – 37%	33 – 35%	33 – 36%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-22 Average and wet period SWP Table A deliveries from the Delta under Current and Future Conditions

	SWP Table A delivery from the Delta (in percent of maximum Table A[1])					
	Average[2]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Reliability Report						
Current (2005)	68%	60%	65%	69%	75%	72%
Future (2025)	77%	95%	97%	93%	93%	89%
Updated studies						
Current (2007)	63%	60%	66%	68%	73%	71%
Future (2027)[3]	66 – 69%	94%	97%	86 – 87%	84 – 87%	80 – 83%

1/ 4,133 taf /year
2/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
3/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Article 21 Deliveries under Different Hydrologic Scenarios

Tables 6-23, 6-24, and 6-25 contain summaries and highlights of estimated SWP Article 21 deliveries from the Delta under Current and Future Conditions from the 2005 SWP Delivery Reliability Report and as derived from updated CalSim II simulations for this report. Overall, the CalSim II simulations from the 2005 report and the updated simulations for 2007 and 2027 conditions tend to show less Article 21 deliveries in the future. Depending upon the climate change scenario, updated estimates of future SWP Article 21 deliveries may increase over updated current values for specific years; however, the long-term average future Article 21 delivery is less than half of the estimate for the current (2007) scenario.

Table 6-23 Annual SWP Article 21 delivery from the Delta under Current and Future Conditions

	Average delivery[1] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Reliability Report			
Current (2005)	260	1110	0
Future (2025)	120	550	0
Update studies			
Current (2007)	90	590	0
Future (2027)[2]	30	410 – 420	0

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-24 Average and dry year SWP Article 21 delivery under Current and Future Conditions (taf per year)

Year	2005 SWP Reliability Report Current (2005)	2005 SWP Reliability Report Future (2025)	Updated studies Current (2007)	Updated studies Future (2027)[2]
1929	0	0	0	0
1930	120	140	0	0
1931	0	0	0	0
1932	240	110	0	0 – 40
1933	510	550	40	20 – 90
1934	210	240	0	0 – 10
1976	190	0	5	0
1977	0	0	0	0 – 10
1987	550	180	0	0
1988	0	0	0	0
1989	0	90	0	0
1990	0	0	0	0
1991	0	0	0	0
1992	0	100	0	0
Long-term Average[1]	260	120	85	30

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6-25 Average and wet year SWP Article 21 delivery under Current and Future Conditions (taf per year)

Year	2005 SWP Reliability Report Current (2005)	2005 SWP Reliability Report Future (2025)	Updated studies Current (2007)	Updated studies Future (2027)[2]
1978	300	300	100	40 – 150
1979	160	140	0	0
1980	140	90	190	90 – 130
1981	550	70	0	0
1982	800	170	490	0
1983	400	360	400	270 – 290
1984	550	490	460	410 – 420
1985	0	0	0	0
1986	120	80	30	0 – 10
1987	550	180	0	0
1978-87 Average	360	190	170	90 – 100
Long-term Average[1]	260	120	85	30

1/ 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies
2/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

SWP Table A Delivery Probability

The current and future probability that a given level of SWP Table A amount will be delivered from the Delta is shown in Figure 6-5 from the 2005 SWP Delivery Reliability Report and in Figure 6-6 for updated studies for this report. In the 2005 report, future Table A deliveries exceeded current deliveries at the 80 percent exceedence level. Under the updated simulations for this report, future Table A deliveries exceed current deliveries at approximately the 60 percent exceedence level. Above this exceedence, future deliveries are larger than current deliveries, with the difference in delivery amount depending upon which climate change scenario is assumed.

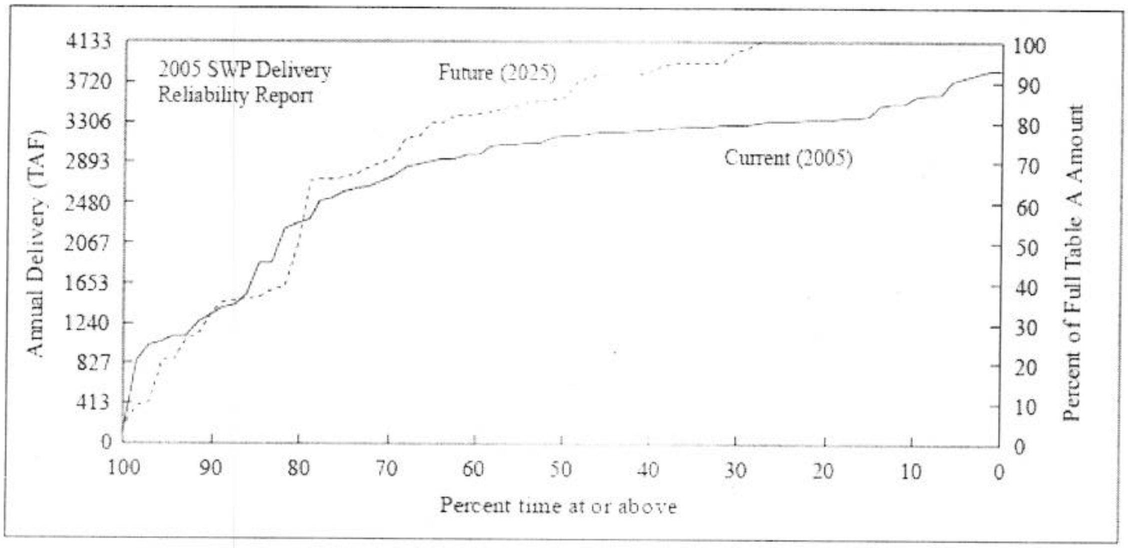

Figure 6-5 Current and future SWP Delta Table A delivery probability from the 2005 SWP Delivery Reliability Report

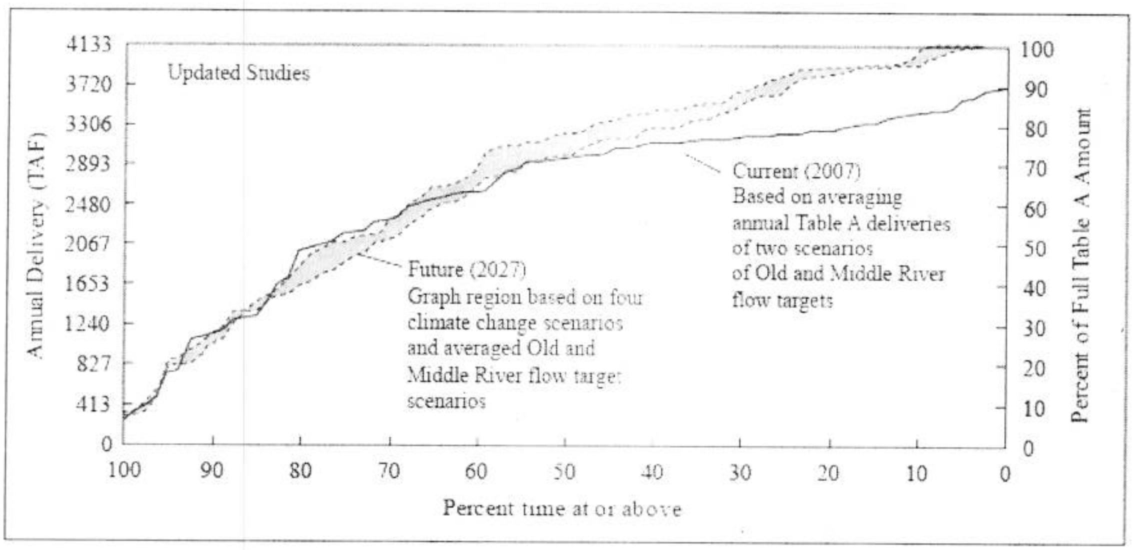

Figure 6-6 Updated current and future SWP Delta Table A delivery probability

Table 6-26 presents SWP Table A delivery values which correspond to 25, 50, and 75 percent exceedence for current and future conditions. Previously in the 2005 report, future annual SWP deliveries were estimated to be larger than current deliveries by approximately 900 taf, 400 taf, and 150 taf for 25%, 50%, and 75% exceedences respectively. For the updated studies, future SWP Table A deliveries associated with a given percent exceedence may also be higher than for the deliveries at the current level (2007), but this difference is significantly less. In fact, future deliveries associated with an exceedence level of above 50% may be less than under current conditions for certain climate change scenarios.

Table 6-26 Highlighted SWP Table A delivery percent exceedence values under Current and Future Conditions

Percent Exceedence	Annual SWP Table A Delivery (taf)			
	2005 SWP Reliability Report		**Updated studies**	
	Current (2005)	Future (2025)	Current (2007)	Future (2027)[1]
25	3323	4133	3218	3687 – 3815
50	3173	3565	2976	2967 – 3205
75	2588	2738	2168	1860 – 2077

1/ Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Chapter 7
Interpreting and Applying the Results for Local Planning Use

Chapter 6 presents a single set of estimates for current-level deliveries and range of results for deliveries 20 years in the future. Chapter 6 and Appendix B explain how these estimates are developed. This chapter provides guidance on how to apply the delivery estimates to water management plans.

All results in this report are presented as percentages of the maximum Table A amount for SWP deliveries from the Delta of 4.133 MAF/yr. Estimates of deliveries for a specific SWP contractor can be converted to acre-feet/year by multiplying the percentages by that contractor's maximum Table A amount. It is possible that the Table A amount for a specific contractor may not be at the ultimate maximum value, but it should be very close to it. The Delta Table A value for 2007 is 4.127 maf/yr, 99.9 percent of the maximum Delta Table A value of 4.133 maf/yr. Therefore, for almost all purposes, this approach should be sufficient for these analyses. In addition, the percentages may also be used to estimate the Table A deliveries to SWP contractors in Butte and Plumas counties and Yuba City. The deliveries to these contractors would be calculated using the same method.

The following two examples are taken from Chapter 6 of *The State Water Project Delivery Reliability Report 2005* and updated with the data from this report. These examples are developed for a hypothetical SWP contractor with a maximum Table A amount of 100,000 acre-feet per year. Hypothetical examples illustrating applications of the delivery probability curves and adjustments to the data for a SWP contractor that cannot convey its maximum Table A amount are provided in *The State Water Project Delivery Reliability Report 2002*. Questions regarding the use of the information contained in these reports may be directed to the Department of Water Resources' Bay-Delta Office at (916) 653-1099.

Example 1

This example uses data directly from Table 6-21 for updated current and future estimates of SWP Table A deliveries during dry periods and employs an allocation methodology that provides a simple means of estimating supplies to each contractor. The analysis includes high and low estimates of the range of values for year 2027. In order to estimate deliveries between current (2007) and future (2027) conditions, the data in the table is interpolated for 5-year increments and contained in Table 7-1. Table 7-1 shows the average percentage of maximum Delta Table A deliveries for average, single-dry year, and 2, 4, and 6-year multiple dry year scenarios from 2007 to 2027 in five-year increments.

The maximum Table A amounts of each contractor are listed in Appendix C. Table A amounts can be amended and a contractor's Table A amount over the next 20 years may be less than its maximum over some or all of this period. In this case, the contractor should use the amended Table A amounts for the corresponding years during this period. To use dry years other than those presented in Table 7-1, or to show year-to-year supplies instead of averages over a multiple-dry year period, see Example 2.

Table 7-1 SWP average and dry year Table A delivery from the Delta in five-year intervals for studies 2007 and 2027

Year	SWP Table A delivery from the Delta (in percent of maximum Table A)					
	Average 1922-2003	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2007	63%	6%	34%	35%	35%	34%
2012	64 – 65%	6%	32%	34 – 36%	35%	34 – 35%
2017	65 – 66%	7%	30 – 31%	34 – 36%	34 – 35%	34 – 35%
2022	66 – 68%	7%	28 – 29%	33 – 37%	34 – 35%	33 – 36%
2027	66 – 69%	7%	26 – 27%	32 – 37%	33 – 35%	33 – 36%

How to Calculate Supplies

In order to estimate delivery amount for the average and drought periods for each 5 year increment from 2007 to 2027, multiply the contractor's Table A amount for a particular year by the corresponding delivery percentages for that year from Table 7-1.

The following tables show the SWP Table A deliveries projected to be available to a hypothetical contractor with a maximum Table A amount of 100,000 AF, on average and for the various drought periods. For this example, the supplies shown for the multiple-dry year period are average supplies over the four-year drought from 1931-1934. Data from other year types, although not required in an urban water management plan, could also be presented this way.

Table 7-2 Average annual SWP deliveries assuming a maximum Table A amount of 100,000 acre-feet (acre-feet)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	63,000	64,000 – 65,000	64,000 – 66,000	65,000 – 68,000	66,000 – 69,000
State Water Project (Article 21)[1]					
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

[1] Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local supply. See discussion of Article 21 supply in Chapter 4.

Table 7-3 Single dry year SWP delivery (1977 conditions) assuming a maximum Table A amount of 100,000 acre-feet (acre-feet)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	6,000	6,000	7,000	7,000	7,000
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7-4 Average SWP Delivery over a multiple dry year period assuming a maximum Table A amount of 100,000 acre-feet 1931-1934 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	35,000	34,000 – 36,000	34,000 – 36,000	33,000 – 37,000	32,000 – 37,000
State Water Project (Article 21)[1]					
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

[1] Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local supply. See discussion of Article 21 supply in Chapter 4.

Example 2

This example is similar to Example 1 but allows a contractor to select alternative single year or multiple-dry year sequences other than those presented in Table 7-1. This option might be selected if analyzing different hydrologic year(s) makes more sense given a contractor's other supply sources, or given the locally acceptable risk level for water delivery shortages.

This example can also be used to identify supplies projected to be available in each year of a multiple-dry year period. While the Water Code does not specifically require this, the Urban Water Management Plan Guidebook suggests showing year-to-year supplies (see the UWMP Guidebook, Section 7, Step 3).

Where to Find the Data

Choose a single year or multiple-year sequences from Tables B-3 and B-12 through B-15 to represent single-dry year and multiple-dry year scenarios. Table B-3 contains the percent of maximum Table A deliveries under all 82 hydrologic years in the updated model study for 2007. Tables B-12 through B-15 contains the percent of maximum Table A deliveries under all 82 hydrologic years in the updated model studies for 2027.

How to Calculate Supplies

Multiply the contractor's Table A amount for a particular year by the percent of maximum Table A deliveries for the selected years, to get an estimated delivery amount for the years selected, for 2007 and 2027. Values for years between 2007 and 2027 can be linearly interpolated.

The following tables show the SWP Table A deliveries projected to be available to a hypothetical contractor with a maximum Table A amount of 100,000 AF, in a single dry year and year-to-year over a multiple dry-year period. For this example, the single dry year selected is for 1988 conditions, and the multiple dry-year period selected is the three-year period from 1990-1992. In showing year-to-year supplies for the multiple-dry year period, these year-to-year supplies should be shown for each five year increment during the 20 year projection period.

Table 7-5 Annual SWP delivery over single dry year (1988 conditions) assuming a maximum Table A amount of 100,000 acre-feet
(acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	11,540	11,490 — 12,000	11,440 — 12,460	11,370 — 12,920	11,320 — 13,380
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7-6 Annual SWP delivery over multiple dry year period 1990-1992 assuming a maximum Table A amount of 100,000 acre-feet
1990 conditions
(acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	8,710	8,080 — 8,590	7,450 — 8,470	6,800 — 8,320	6,170 — 8,200
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7-7 Annual SWP delivery over multiple dry year period 1990-1992 assuming a maximum Table A amount of 100,000 acre-feet 1991 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	17,640	17,980 — 18,485	18,290 — 19,360	18,630 — 20,200	18,950 — 21,050
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7-8 Annual SWP delivery over multiple dry year period 1990-1992 assuming a maximum Table A amount of 100,000 acre-feet 1992 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	26,300	26,180 — 26,880	26,030 — 27,460	25,910 — 28,040	25,770 — 28,620
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Appendix A. 2007 Delivery Reliability Report CalSim II Modeling Assumptions

The CalSim II model developed for the 2004 Long-Term Central Valley Project Operations Criteria and Plan (OCAP) was modified specifically for the studies in this report. The model for this report assumes a D-1641 regulatory environment and implements the 2007 federal court decision on remedy actions for the Delta smelt. Two of the proposed actions in that decision, actions 6 and 8, specify a range in upstream flow targets for Old River and Middle River (OMR). The model studies for this report consider both the high and low remedy actions for actions 6 and 8 to bookend the potential effects. The assumptions for the remedy actions are shown in the following table.

Action	Period	OMR Standard (flow upstream in cfs)	
		Remedy Action High	Remedy Action Low
4	December 25 – January 3	< 2000	< 2000
5	January 4 – February 20	< 5000	< 5000
6	February 21 – April 14	< 750	< 5000
7	April 15 – May 15	No OMR standard. VAMP controls export.	No OMR standard. VAMP controls export.
8	May 16 – June 30	< 750	< 5000

Where: OMR = 0.58 * (flow @ Vernalis) – 0.913 * (Total Export)

The remedy actions incorporate the Vernalis Adaptive Management Plan (VAMP) export curtailments for the period April 15 – May 15 with impacts borne by the projects. The VAMP criteria applied in the model are as follows:

Vernalis flow (cfs)	Combined exports (cfs)
< 5700	< 1500
= 5700	< 2250
> 5700 and =< 8600	< 1500 or < 3000 (alternating standard)
> 8600	< 0.5 * Vernalis

The 2004 OCAP model version was also modified to include the three improvements listed below.

1. The previous San Joaquin River Basin representation was replaced by the San Joaquin River Water Quality Module version 1.00 (SJRWQM) developed by U.S. Bureau of Reclamation Mid-Pacific Region. The SJRWQM is an update to previous versions that has gone through extensive agency review and a formal peer review.
2. The previous Artificial Neural Network (ANN) used to estimate flow-salinity relationships has been replaced with a newer more accurate version. The new ANN, and its accompanying implementation to the CalSim II model, produces salinities that match more closely to Delta Simulation Model 2 (DSM2) salinities.
3. The Hydrologic sequence of simulated years has been extended to include the water years 1995 – 2003. The new simulation period spans water years 1922 – 2003 whereas the previous sequence covered water years 1922- 1994.

All studies assume current SWP Delta diversion limits (often referred to as "Banks Pumping Plant capacity"), existing conveyance capacity of the upper Delta-Mendota Canal/California Aqueduct system, and current SWP/CVP operations agreements. The following table is a complete list of the study assumptions.

Table A-1 2007 Delivery Reliability Report CalSim II modeling assumptions

	2007 Studies	2027 Studies
Period of Simulation	82 years (1922-2003)	Same
HYDROLOGY		
Level of Development (Land Use)	2005 Level, DWR Bulletin 160-98[1]	2020 Level, DWR Bulletin 160-98[2]
Demands		
North of Delta (except American River)		
CVP	Land Use based, limited by Full Contract	Same
SWP (FRSA)	Land Use based, limited by Full Contract	Same
Non-Project	Land Use based	Same
CVP Refuges	Firm Level 2	Same
American River Basin		
Water rights	2001 Level[3]	2020 Level[4]
CVP	2001 Level[3]	2020 Level[4]
San Joaquin River Basin		
Friant Unit	Limited by contract amounts, based on current allocation policy	Same
Lower Basin	Land-use based, based on district level operations and constraints.	Same
Stanislaus River Basin	Land-use based, based on New Melones Interim Operations Plan[5]	Same
South of Delta		
CVP	Full Contract	Same

1 The 2005 Level of Development for the Sacramento Valley is defined by linearly interpolated values from the 1995 Level of Development and 2020 Level of Development from DWR Bulletin 160-98. The San Joaquin Valley hydrology reflects 2005 land-use assumptions developed by Reclamation to support Reclamation studies.

2 The 2020 Level of Development for the Sacramento Valley is from DWR Bulletin 160-98. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation to support Reclamation studies.

3 Presented in attached table of 2007 Study American River Demand Assumptions.

4 Presented in attached table of 2027 Study American River Demand Assumptions.

5 CalSim II model representation for the Stanislaus River does not necessarily represent Reclamation's current or future operational policies.

	2007 Studies	2027 Studies
CCWD	151 TAF/YR [6]	Same
SWP (with North Bay Aqueduct)	2.3-3.9 MAF/YR	3.9-4.1 MAF/YR
SWP Article 21 Demand	MWDSC up to 100 TAF/month, Dec-Mar, others up to 84 TAF/month	Same
FACILITIES		
Freeport Regional Water Project	None	Included [7]
Banks Pumping Capacity	6680 cfs	Same
Tracy Pumping Capacity	4200 cfs + deliveries upstream of DMC constriction	Same
REGULATORY STANDARDS		
Trinity River		
Minimum Flow below Lewiston Dam	369-453 TAF/YR	Trinity EIS Preferred Alternative (369-815 TAF/YR)
Trinity Reservoir End-of-September Minimum Storage	Trinity EIS Preferred Alternative (600 TAF as able)	Same
Clear Creek		
Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to FWS and NPS, and FWS use of CVPIA 3406(b)(2) water	Same
Upper Sacramento River		
Shasta Lake End-of-September Minimum Storage	SWRCB WR 1993 Winter-run Biological Opinion (1900 TAF)	Same
Minimum Flow below Keswick Dam	Flows for SWRCB WR 90-5 and 1993 Winter-run Biological Opinion temperature control, and FWS use of CVPIA 3406(b)(2) water	Same
Feather River		
Minimum Flow below Thermalito Diversion Dam	1983 DWR, DFG Agreement (600 CFS)	Same
Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (750 – 1700 CFS)	Same
Yuba River		
Minimum flow below Daguerre Point Dam	Interim D-1641 operations	Lower Yuba River Accord

[6] Delta diversions include operations of Los Vaqueros Reservoir and represents average annual diversion.

7 Includes modified EBMUD operations of the Mokelumne River.

	2007 Studies	2027 Studies
American River		
Minimum Flow below Nimbus Dam	SWRCB D-893 (see accompanying Operations Criteria), and FWS use of CVPIA 3406(b)(2) water	Same
Minimum Flow at H Street Bridge	SWRCB D-893	Same
Lower Sacramento River		
Minimum Flow near Rio Vista	SWRCB D-1641	Same
Mokelumne River		
Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100 – 325 CFS)	Same
Minimum Flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25 – 300 CFS)	Same
Stanislaus River		
Minimum Flow below Goodwin Dam	1987 USBR, DFG agreement , and FWS use of CVPIA 3406(b)(2) water	Same
Minimum Dissolved Oxygen	SWRCB D-1422	Same
Merced River		
Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 CFS, Nov – Mar), and Cowell Agreement	Same
Minimum Flow at Shaffer Bridge	FERC 2179 (25 – 100 CFS)	Same
Tuolumne River		
Minimum Flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94 – 301 TAF/YR)	Same
San Joaquin River		
Maximum Salinity near Vernalis	SWRCB D-1641	Same
Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement	Same
Sacramento River-San Joaquin River Delta		
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641	Same
Delta Cross Channel Gate Operation	SWRCB D-1641	Same
Delta Exports	SWRCB D-1641, FWS use of CVPIA 3406(b)(2) water and CALFED Fisheries Agencies use of EWA assets	Same

	2007 Studies	2027 Studies
OPERATIONS CRITERIA		
Subsystem		
Upper Sacramento River		
Flow Objective for Navigation (Wilkins Slough)	3,250 – 5,000 CFS based on CVP Ag allocation levels	Same
American River		
Folsom Dam Flood Control	SAFCA, Interim re-operation of Folsom Dam, Variable 400/670 (without outlet modifications)	Same
Flow below Nimbus Dam	Operations criteria corresponding to SWRCB D-893 required minimum flow	Same
Sacramento Water Forum Mitigation Water	None	Sacramento Water Forum (up to 47 TAF/YR in dry years) [8]
Feather River		
Flow at Mouth	Maintain the DFG/DWR flow target above Verona or 2800 cfs for Apr– Sep dependent on Oroville inflow and FRSA allocation	Same
Stanislaus River		
Flow below Goodwin Dam	1997 New Melones Interim Operations Plan	Same
San Joaquin River		
Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program	Same
System-wide		
CVP Water Allocation		
CVP Settlement and Exchange	100% (75% in Shasta Critical years)	Same
CVP Refuges	100% (75% in Shasta Critical years)	Same
CVP Agriculture	100% - 0% based on supply (reduced by 3406(b)(2) allocation)	Same
CVP Municipal & Industrial	100% - 50% based on supply (reduced by 3406(b)(2) allocation)	Same
SWP Water Allocation		

8 This is implemented only in the PCWA Middle Fork Project releases used in defining the CalSim II inflows to Folsom Lake.

	2007 Studies	2027 Studies
North of Delta (FRSA)	Contract specific	Same
South of Delta	Based on supply; Monterey Agreement	Same
CVP/SWP Coordinated Operations		
Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement	Same
Sharing of Surplus Flows	1986 Coordinated Operations Agreement	Same
Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641	Same
Transfers		
Dry Year Program	None	Same
Phase 8	None	Same
MWDSC/CVP Settlement Contractors	None	Same
CVP/SWP Integration		
Dedicated Conveyance at Banks	None	Same
NOD Accounting Adjustments	None	Same

Table A-2 2007 Study American River demand assumptions

Location / Purveyor	ALLOCATION TYPE (MAXIMUM)					
	CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total
Auburn Dam Site (D300)						
Placer County Water Agency	0	0	0	8,500	0	8,500
Total	**0**	**0**	**0**	**8,500**	**0**	**8,500**
Folsom Reservoir (D8)						
Sacramento Suburban	0	0	0	0	0	0
City of Folsom (includes P.L. 101-514)	0	0	0	20,000	0	20,000
Folsom Prison	0	0	0	2,000	0	2,000
San Juan Water District (Placer County)	0	0	0	10,000	0	10,000
San Juan Water District (Sacramento County) (includes P.L. 101-514)	0	11,200	0	33,000	0	44,200
El Dorado Irrigation District	0	7,550	0	0	0	7,550
El Dorado Irrigation District (P.L. 101-514)	0	0	0	0	0	0
City of Roseville	0	32,000	0	0	0	32,000
Placer County Water Agency	0	0	0	0	0	0
Total	**0**	**50,750**	**0**	**65,000**	**0**	**115,750**
Folsom South Canal (D9)						
So. Cal WC/ Arden Cordova WC	0	0	0	3,500	0	3,500
California Parks and Recreation	0	100	0	0	0	100
SMUD (export)	0	0	0	15,000	0	15,000
South Sacramento County Agriculture (export, SMUD transfer)	0	0	0	0	0	0
Canal Losses	0	0	0	1,000	0	1,000
Total	**0**	**100**	**0**	**19,500**	**0**	**19,600**

	ALLOCATION TYPE (MAXIMUM)					
Location / Purveyor	CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total
Nimbus to Mouth (D302)						
City of Sacramento	0	0	0	63,335	0	63,335
Arcade Water District	0	0	0	2,000	0	2,000
Carmichael Water District	0	0	0	8,000	0	8,000
Total	**0**	**0**	**0**	**73,335**	**0**	**73,335**
Sacramento River (D162)						
Placer County Water Agency	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**
Sacramento River (D167/D168)						
City of Sacramento	0	0	0	38,665	0	38,665
Sacramento County Water Agency (SMUD transfer)	0	0	0	0	0	0
Sacramento County Water Agency (P.L. 101-514)	0	0	0	0	0	0
EBMUD (export)	0	0	0	0	0	0
Total	**0**	**0**	**0**	**38,665**	**0**	**38,665**
Total from the American River	**0**	**50,850**	**0**	**166,335**	**0**	**217,185**

Table A-3 2027 Study American River demand assumptions

Location / Purveyor	ALLOCATION TYPE (MAXIMUM) CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total	Folsom Unimpaired Inflow (FUI) FUI = Total TAF (Mar – Sep) + 60 TAF > 1600	> 950	< 400	Notes
Auburn Dam Site (D300)										
Placer County Water Agency	0	0	0	35,500	0	35,500	35,500	35,500	35,500	1/2/3/11
Total	**0**	**0**	**0**	**35,500**	**0**	**35,500**	**35,500**	**35,500**	**35,500**	
Folsom Reservoir (D8)										
Sacramento Suburban	0	0	0	29,000	0	29,000	29,000	0	0	4/5/10
City of Folsom (includes P.L. 101-514)	0	7,000	0	27,000	0	34,000	34,000	34,000	20,000	1/2/3
Folsom Prison	0	0	0	2,000	0	2,000	2,000	2,000	2,000	
San Juan Water District (Placer County)	0	0	0	25,000	0	25,000	25,000	25,000	10,000	1/2/3/10
San Juan Water District (Sac County) (includes P.L. 101-514)	0	24,200	0	33,000	0	57,200	57,200	57,200	44,200	1/2/3
El Dorado Irrigation District	0	7,550	0	0	0	7,550	7,550	7,550	7,550	1/2/3
El Dorado Irrigation District (P.L. 101-514)	0	7,500	0	0	0	7,500	7,500	7,500	1,450	1/2/3
City of Roseville	0	32,000	0	30,000	0	62,000	54,900	54,900	39,800	1/2/3/10/11
Placer County Water Agency	0	0	0	0	0	0	0	0	0	10
Total	**0**	**78,250**	**0**	**146,000**	**0**	**224,250**	**217,150**	**188,150**	**125,000**	
Folsom South Canal (D9)										
So. Cal WC/ Arden Cordova WC	0	0	0	5,000	0	5,000	5,000	5,000	5,000	
California Parks and Recreation	0	5,000	0	0	0	5,000	5,000	5,000	5,000	
SMUD (export)	0	15,000	0	15,000	0	30,000	30,000	30,000	15,000	1/2/3
South Sacramento County Agriculture (export, SMUD transfer)	35,000	0	0	0	0	35,000	35,000	0	0	4/5
Canal Losses	0	0	0	1,000	0	1,000	1,000	1,000	1,000	
Total	**35,000**	**20,000**	**0**	**21,000**	**0**	**76,000**	**76,000**	**41,000**	**26,000**	
Nimbus to Mouth (D302)										
City of Sacramento	0	0	0	96,300	0	96,300	96,300	96,300	50,000	6/7/8
Arcade Water District	0	0	0	11,200	0	11,200	11,200	11,200	3,500	12

Location / Purveyor	ALLOCATION TYPE (MAXIMUM)						Folsom Unimpaired Inflow (FUI) FUI = Total TAF (Mar – Sep) + 60 TAF			Notes
	CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total	> 1600	> 950	< 400	
Carmichael Water District	0	0	0	12,000	0	12,000	12,000	12,000	12,000	
Total	**0**	**0**	**0**	**119,500**	**0**	**119,500**	**119,500**	**119,500**	**65,500**	
Sacramento River (D162)										
Sacramento Suburban	0	0	0	29,000	0	29,000	0	29,000	29,000	4/5
Total	**0**	**0**	**0**	**29,000**	**0**	**29,000**	**0**	**29,000**	**29,000**	
Sacramento River (D167/D168)										
City of Sacramento	0	0	0	34,300	0	34,300	34,300	34,300	80,600	8
Sacramento County Water Agency (SMUD transfer)	0	30,000	0	0	0	30,000				9
Sacramento County Water Agency (P.L. 101-514)	0	15,000	0	0	0	15,000				9
EBMUD (export)	0	133,000	0	0	0	133,000				
Total	**0**	**178,000**	**0**	**34,300**	**0**	**212,300**	**34,300**	**34,300**	**80,600**	
Total demands from the American River	**35,000**	**98,250**	**0**	**322,000**	**0**	**455,250**	**448,150**	**384,150**	**252,000**	

Notes

1/ Wet/average years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is greater than 950,000 af.

2/ Drier years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 950,000 af but greater than 400,000 af.

3/ Driest years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 400,000 af.

4/ Wet/average years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is greater than 1,600,000 af.

5/ Drier years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 1,600,000 af.

6/ Wet/average years as it applies to the City of Sacramento are time periods when the flows bypassing the E. A. Fairbairn Water Treatment Plant diversion exceed the "Hodge flows."

7/ Drier years are time periods when the flows bypassing the City's E.A. Fairbairn Water Treatment Plant diversion do not exceed the "Hodge flows."

8/ For modeling purposes, it is assumed that the City of Sacramento's total annual diversions from the American and Sacramento River in year 2030 would be 130,600 af.

9/ The total demand for Sacramento County Water Agency would be up to 78,000 af. The 45,000 af represents firm entitlements; the additional 33,000 af of demand is expected to be met by intermittent surplus supply. The intermittent supply is subject to Reclamation reduction (50%) in dry years.

10/ Water Rights Water provided by releases from PCWA's Middle Fork Project; inputs into upper American River model must be consistent with these assumptions.

11/ Demand requires "Replacement Water" as indicated below

12/ Arcade WD demand modeled as step function: one demand when FUI > 400, another demand when FUI < 400.

Appendix B. Results of Report CalSim II Studies

The supply reliability of the State Water Project is estimated in studies by using a computer program that simulates the operation of the SWP on a monthly basis over an 82-year historical record of rainfall and runoff (1922–2003). The simulation model integrates all the relevant water resource components and calculates key water management parameters, such as:

- the amount of water released from reservoirs in the Sacramento-San Joaquin valleys,
- the amount of water required to maintain Delta water quality standards,
- the amount of water to be pumped from the Delta by the SWP and the Central Valley Project (CVP), and
- the amount of water that can be delivered by each of these projects.

The information required to run the simulation is referred to as the "model input." The most significant categories of input are:

- the physical description of the water system facilities (maximum pumping or release capacity, maximum reservoir storages, etc.);
- institutional requirements (delivery contract requirements, Delta water quality standards, the operations agreement between the SWP and CVP, endangered species requirements, and other requirements of federal and state laws, etc);
- hydrology (river and stream flows adjusted for water use in the source areas); and
- the level of SWP water demand.

CalSim II is the current version of the computer simulation model used to estimate SWP delivery reliability. All versions of CalSim employ commercially available linear programming software as a solution device. The application of the software, graphical user interface, and input/output devices are discussed in the documentation for CalSim which is available at http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSimII/

The model studies selected for this report are intended to estimate current SWP delivery reliability and future SWP delivery reliability in the year 2027. Estimating current SWP delivery reliability assumes the SWP and CVP operate to meet Old and Middle River flow targets specified in the 2007 federal court ruling on interim measures to protect delta smelt. Estimating future SWP delivery reliability in 2027 assumes an altered hydrology due to climate change, no new facilities or improvements to existing facilities, an increased SWP water demand, and existing institutional requirements, including the 2007 federal court ruling.

As listed in Table B-1, a total of twelve CalSim II simulations were used in this report: two for estimating current (2007) SWP delivery reliability and ten for estimating future (2027) SWP delivery reliability. Two simulations were needed for estimating current reliability due to uncertainty in which Old and Middle River flow target might apply. The 2007 proposed federal court ruling gave discretion to USFWS to determine whether at times a more or less restrictive flow target should be met based upon USFWS's assessment of the vulnerability of delta smelt at that time. The yearly annual SWP deliveries from these two studies were averaged to yield a single sequence of annual SWP deliveries to describe Current Conditions while incorporating average impacts to deliveries due to Old and Middle River flow targets contained in the federal court ruling.

Table B-1 Summary of CalSim II simulations used to update SWP delivery estimates

Time Frame	Climate Change Model	Greenhouse Gas Emissions Scenario	Old and Middle River flow target targets[1]
Current	None	None	Less restrictive
Current	None	None	More restrictive
Future	None	None	Less restrictive
Future	None	None	More restrictive
Future	Geophysical Fluid Dynamic Lab Model	A2	Less restrictive
Future	Geophysical Fluid Dynamic Lab Model	A2	More restrictive
Future	Geophysical Fluid Dynamic Lab Model	B1	Less restrictive
Future	Geophysical Fluid Dynamic Lab Model	B1	More restrictive
Future	Parallel Climate Model	A2	Less restrictive
Future	Parallel Climate Model	A2	More restrictive
Future	Parallel Climate Model	B1	Less restrictive
Future	Parallel Climate Model	B1	More restrictive

1/ The Geophysical Fluid Dynamic Lab model and PCM refers to the Parallel Climate model. The GFDL model indicates a greater warming tread than the PCM. A2 emissions scenario assumes high growth in population, regional based economic growth, and slow technological changes, which results in significantly higher greenhouse gas emissions. B2 emissions scenario represents low growth in population, global based economic growth and sustainable development that results in a low increase in greenhouse gas emissions.

2/ Less restrictive Old and Middle River flow targets refer to combined Old and Middle River flow not more than 5,000 cfs in upstream direction in February 21 – April 14; June 1-30. More restrictive Old and Middle River flow targets refer to combined Old and Middle River flow being not more than 750 cfs in upstream direction during February 21 – April 14 and June 1 – 30 (see Table 6-3).

maf = million acre-feet; taf = thousand acre-feet

Ten CalSim II simulations were needed to estimate future (2027) reliability due three factors: 1) uncertainty in how climate change may impact the source water for SWP, 2) the need to adjust CalSim II results to account for the climate change scenarios assuming a 2050 level of emissions, and 3) uncertainty in which Old and Middle River flow target might apply. The ten simulations consist of four climate change scenarios and a no-climate-change scenario which each assume two scenarios of Old and Middle River flow targets. The four climate change scenarios are defined by the climate change model used and the assumed greenhouse gas emissions scenario. One emissions scenario, referred to as "A2," assumes high growth in population, regional based economic growth, and slow technological changes, which results in significantly higher greenhouse gas emissions. The other emissions scenario, "B1," represents low growth in population, global based economic growth and sustainable development that results in a low increase in greenhouse gas emissions. The climate change models used are the Geophysical Fluid Dynamic Lab model (GFDL) and the Parallel Climate model (PCM). Both models project future warming although the GFDL model indicates a greater warming tread than the PCM. The climate change scenarios used in this report to describe future SWP delivery reliability then are: 1) A2 emissions scenario with the GFDL model, 2) B1 emissions with the GFDL model, 3) A2 emissions with the PCM model, and 4) B1 emissions with the PCM model. Each climate change scenario generates two sequences of future SWP deliveries due to each assuming two scenarios of Old and Middle River flow targets.

The ten CalSim II simulations were used to generate four sequences of future (2027) SWP deliveries which are used to describe future SWP delivery reliability in Chapter 6 of this report. This process consisted of first interpolating between sequences to estimate SWP deliveries under climate change affects for 2027 instead of 2050, then averaging each pair of sequences differentiated by Old and Middle River flow targets scenario. The A2 and B1 greenhouse gas emissions scenarios assume a 2050 level of emissions. Scenarios for 2027 were not available at the time of composing this report. A key assumption in estimating 2027 SWP delivery reliability for this report is that SWP deliveries for a CalSim II simulation which assumes 2027 SWP demands and 2027 climate change, would fall somewhere between CalSim II simulations which assume 2027 SWP demands and no climate change and 2027 SWP demands and climate change corresponding to 2050 emissions. Just where these SWP deliveries would fall is estimated in this report by interpolating between each sequence from a scenario which assumes 2050 emissions and a scenario which assumes no climate change. The interpolation is as follows:

Future (2027) annual SWP delivery = NCC + (20/43) (CC – NCC)

Where NCC = annual SWP delivery for future, no climate change scenario
CC = annual SWP delivery for future with climate change scenario which assumes 2050 emission levels

The ratio of 20/43 corresponds to the ratio of calendar years: (2027-2007)/(2050-2007).

The key study assumptions are described in detail in Chapter 3 and Appendix A. Additional discussions of the Operations Criteria and Plan (OCAP) studies are on the US Bureau of Reclamation's Website (http://www.usbr.gov/mp/cvo/ocap_page.html).

Study Results

The annual delivery amounts estimated by the twelve CalSim II simulations are contained in Tables B-3 through B-15. The tables show the demand level, the amount of delivery from the Delta, and percent of maximum total Table A amounts for the SWP contractors receiving water from the Delta. Of the 29 SWP contractors, 26 receive their deliveries from the Delta. The total maximum Table A amount for all SWP contractors is 4.173 maf/year. Of this amount, 4,133 taf/yr is the maximum Delta Table A amount. Also presented are the results of interpolating and averaging SWP delivery sequences which provide the information used in Chapter 6 in assessing current and future SWP delivery reliability. Current and future SWP deliveries are presented both in time sequence and by ranking to correspond to the data presented in the summary/highlight tables and used to generate the probability curves in Chapter 6.

These values must be interpreted within the context of the assumptions upon which they are calculated. For example, for the year 1958 in the 2027 study which assumes PCM model with high emissions and less restrictive Old and Middle River flow targets, the annual delivery is calculated to be 4,133 taf or 100 percent of maximum Delta Table A (see Tables B-4 and B-9). This result should be stated as follows: under the assumptions of (1) rainfall that was similar to what it was in 1958 but modified to reflect climate change effects as predicted by PCM model under assumed higher emissions; (2) the level of water use in the source area is increased to the level it would be in 2027; (2) SWP facilities and operation requirements are the same as they are today with less restrictive Old and Middle River flow targets in effect; and (3) SWP contractor demands are at their maximum Delta Table A level, then SWP would deliver approximately 4,133 taf or 100 percent of the maximum Delta Table A.

Actually, the conditional statement associated with the result for any particular year is even more complicated than this because the result is also dependent upon the rainfall that has occurred in previous years. For example, if the previous year (1957) was wet, runoff for 1958 for the same amount of rainfall would be greater than if 1957 were dry. In addition, reservoir storage for the beginning of 1958 varies depending upon the weather conditions in 1957. Thus, each year's simulation is dependent on the previous year's simulation and, hence, any year in the entire historical sequence is linked to all previous years.

Table B-2 summarizes the delivery estimates for the SWP for important dry sequences computed in the studies for current (2007) and future (2027) conditions. The percentages of maximum Table A amounts are based on averaging current deliveries and interpolating and then averaging future annual SWP Table A deliveries as previously discussed. This information can be helpful in analyzing the delivery reliability of a specific water system that receives a portion of its water supply from the SWP. The series of data contained in Tables B-3 through B-15 are also helpful in analyzing longer periods of time that contain not only dry periods but wetter periods which can replenish water supplies.

Finally, probability distribution curves derived from the CalSim II simulations used in this report are presented in Figures B-1 B-4 to visually show the estimated percentage of years a given annual delivery is equaled or exceeded. In this report, this value represents the probability of receiving at least a given level of delivery in any particular year. As a reference, probability distribution curves for the 2005 and 2025 studies from the 2005 State Water Project Delivery Reliability Report are presented along with the curves from the 2007 and 2027 studies in this report. SWP Table A delivery values for 25%, 50%, and 75% exceedences are shown for all scenarios in Table B-16.

Table B-2 SWP average and dry year Table A delivery from the Delta (in percent of maximum Table A amounts[1])

Time Frame	Climate Change Model	Emissions Scenario	1922-2003 Average	Single dry year 1977	2-year drought 1976-77	4-year drought 1931-34	6-year drought 1987-1992	6-year drought 1929-1934
Current 2007	none	none	63%	6%	34%	35%	35%	34%
Future 2027	Geophysical Fluid Dynamic Lab Model	A2	66%	7%	26%	32%	34%	34%
		B1	66%	7%	27%	32%	33%	33%
	Parallel Climate Model	A2	67%	7%	26%	33%	33%	34%
		B1	69%	7%	27%	37%	35%	36%

1/ 4,133 taf/year

Table B-3 SWP Table A deliveries under Current (2007) Conditions Derived values for estimating probability curve

Year	Table A demands (taf)	SWP Table A deliveries for 2007 studies: lower flow target[2] (taf)	higher flow target[2] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[3]	Ranking of calculated Table A deliveries for probability curve[1]: Year	Table A Delivery (taf)	Exceedence Frequency (%)
1922	3,752	3,737	3,611	3,674	89%	1993	3,711	0%
1923	3,253	3,250	3,067	3,159	76%	1927	3,699	1%
1924	3,491	529	272	400	10%	1922	3,674	3%
1925	3,355	1,528	1,759	1,644	40%	1978	3,599	4%
1926	3,395	2,449	1,923	2,186	53%	1956	3,581	5%
1927	3,862	3,782	3,616	3,699	89%	1951	3,497	6%
1928	3,460	2,165	1,953	2,059	50%	1959	3,465	8%
1929	2,909	840	667	753	18%	2000	3,451	9%
1930	3,328	2,076	1,980	2,028	49%	1996	3,440	10%
1931	2,935	1,158	1,053	1,105	27%	1999	3,439	11%
1932	3,141	1,449	1,161	1,305	32%	1963	3,406	12%
1933	3,429	2,211	1,751	1,981	48%	1938	3,394	14%
1934	3,472	1,272	1,357	1,315	32%	1935	3,334	15%
1935	3,800	3,619	3,050	3,334	81%	1953	3,323	16%
1936	3,598	3,422	2,826	3,124	76%	1971	3,317	17%
1937	3,544	3,210	3,227	3,219	78%	1968	3,297	19%
1938	3,396	3,394	3,394	3,394	82%	1966	3,265	20%
1939	3,264	3,257	3,256	3,256	79%	1970	3,257	21%
1940	3,241	3,208	3,122	3,165	77%	1939	3,256	22%
1941	2,528	2,526	2,526	2,526	61%	1984	3,227	24%
1942	3,169	3,167	3,167	3,167	77%	1937	3,219	25%
1943	3,156	3,154	3,154	3,154	76%	1975	3,218	26%
1944	3,092	2,971	2,888	2,930	71%	1954	3,201	27%
1945	3,114	3,088	3,082	3,085	75%	1946	3,199	28%
1946	3,217	3,215	3,183	3,199	77%	1985	3,198	30%
1947	3,424	2,637	1,992	2,314	56%	1974	3,184	31%
1948	3,397	2,637	2,582	2,609	63%	1942	3,167	32%
1949	3,315	1,423	1,119	1,271	31%	1940	3,165	33%
1950	3,467	2,629	2,294	2,462	60%	1923	3,159	35%
1951	3,499	3,497	3,497	3,497	85%	1943	3,154	36%
1952	2,587	2,585	2,585	2,585	63%	1989	3,130	37%
1953	3,325	3,323	3,323	3,323	80%	1979	3,128	38%
1954	3,296	3,293	3,110	3,201	77%	1981	3,128	40%
1955	3,230	1,202	1,071	1,137	28%	1936	3,124	41%
1956	3,583	3,581	3,581	3,581	87%	1997	3,101	42%
1957	3,237	2,670	2,420	2,545	62%	1973	3,085	43%
1958	3,032	3,029	3,030	3,030	73%	1945	3,085	45%
1959	3,549	3,389	3,541	3,465	84%	1958	3,030	46%
1960	3,557	1,665	1,255	1,460	35%	1998	3,008	47%
1961	3,582	2,517	2,197	2,357	57%	1995	2,993	48%
1962	3,692	2,908	3,015	2,962	72%	1967	2,990	49%
1963	3,825	3,717	3,095	3,406	82%	1962	2,962	51%
1964	3,494	2,018	2,404	2,211	53%	2003	2,943	52%
1965	3,061	3,028	2,693	2,861	69%	1982	2,940	53%

1/ See Table 6-3   2 / Values used to describe Current Conditions in Chapter 6   3/ 4,133 taf/year

Table B-3 (cont.) SWP water delivery from the Delta under Current (2007) Conditions Derived values for estimating probability curve

		SWP Table A deliveries for 2007 studies				Ranking of calculated Table A deliveries for probability curve[1]		
Year	Table A demands (taf)	lower flow target[2] (taf)	higher flow target[2] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[3]	Year	Table A Delivery (taf)	Exceedence Frequency (%)
1966	3,284	3,282	3,249	3,265	79%	1944	2,930	54%
1967	3,002	2,989	2,991	2,990	72%	1965	2,861	56%
1968	3,326	3,324	3,270	3,297	80%	1987	2,825	57%
1969	2,638	2,626	2,625	2,626	64%	1980	2,710	58%
1970	3,259	3,257	3,257	3,257	79%	1969	2,626	59%
1971	3,343	3,329	3,305	3,317	80%	1948	2,609	61%
1972	3,459	1,881	1,533	1,707	41%	1976	2,604	62%
1973	3,099	3,094	3,077	3,085	75%	1952	2,585	63%
1974	3,186	3,184	3,183	3,184	77%	1957	2,545	64%
1975	3,231	3,229	3,206	3,218	78%	1941	2,526	66%
1976	3,473	2,973	2,234	2,604	63%	1983	2,497	67%
1977	3,423	225	260	243	6%	1950	2,462	68%
1978	3,625	3,598	3,601	3,599	87%	1961	2,357	69%
1979	3,514	3,249	3,007	3,128	76%	1947	2,314	70%
1980	2,717	2,711	2,709	2,710	66%	1986	2,294	72%
1981	3,360	3,273	2,982	3,128	76%	1964	2,211	73%
1982	2,942	2,940	2,940	2,940	71%	1926	2,186	74%
1983	2,499	2,497	2,497	2,497	60%	2002	2,162	75%
1984	3,229	3,227	3,227	3,227	78%	1994	2,105	77%
1985	3,216	3,213	3,184	3,198	77%	1928	2,059	78%
1986	2,323	2,294	2,294	2,294	56%	1930	2,028	79%
1987	2,898	2,868	2,782	2,825	68%	1933	1,981	80%
1988	2,969	544	409	477	12%	1972	1,707	82%
1989	3,553	3,132	3,129	3,130	76%	1925	1,644	83%
1990	3,630	500	220	360	9%	1960	1,460	84%
1991	3,427	806	652	729	18%	1934	1,315	85%
1992	3,368	1,096	1,078	1,087	26%	1932	1,305	87%
1993	3,864	3,846	3,576	3,711	90%	1949	1,271	88%
1994	3,672	2,071	2,138	2,105	51%	2001	1,164	89%
1995	3,015	2,995	2,992	2,993	72%	1955	1,137	90%
1996	3,441	3,440	3,440	3,440	83%	1931	1,105	91%
1997	3,308	3,026	3,176	3,101	75%	1992	1,087	93%
1998	3,015	3,008	3,007	3,008	73%	1929	753	94%
1999	3,441	3,440	3,439	3,439	83%	1991	729	95%
2000	3,469	3,463	3,439	3,451	84%	1988	477	96%
2001	3,710	1,334	994	1,164	28%	1924	400	98%
2002	3,847	2,470	1,853	2,162	52%	1990	360	99%
2003	3,469	3,130	2,756	2,943	71%	1977	243	100%
Avg	3,309	2,658	2,531	2,595	63%		2,595	
Min	2,323	225	220	243	6%		243	
Max	3,864	3,846	3,616	3,711	90%		3,711	

1/ See Table 6-3 2/ Values used to describe Current Conditions in Chapter 6 3/ 4,133 taf/year

Table B-4 SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with A2 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	4,057	98%	4,068	98%	4,062	98%
1923	4,133	3,114	75%	2,056	50%	2,622	63%
1924	4,133	438	11%	750	18%	583	14%
1925	4,133	1,628	39%	1,470	36%	1,554	38%
1926	4,133	2,414	58%	2,149	52%	2,291	55%
1927	4,133	4,133	100%	3,816	92%	3,986	96%
1928	4,133	2,109	51%	2,160	52%	2,133	52%
1929	4,133	847	20%	881	21%	863	21%
1930	4,133	2,357	57%	2,470	60%	2,410	58%
1931	4,133	1,098	27%	1,066	26%	1,083	26%
1932	4,133	1,512	37%	1,352	33%	1,437	35%
1933	4,133	2,274	55%	1,357	33%	1,847	45%
1934	4,133	1,327	32%	1,312	32%	1,320	32%
1935	4,133	3,734	90%	3,205	78%	3,488	84%
1936	4,133	3,569	86%	3,682	89%	3,622	88%
1937	4,133	3,510	85%	2,292	55%	2,943	71%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,488	60%	3,044	74%
1940	4,133	3,642	88%	3,749	91%	3,691	89%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,133	100%	3,633	88%	3,900	94%
1943	4,133	3,849	93%	3,535	86%	3,703	90%
1944	4,133	2,924	71%	2,131	52%	2,555	62%
1945	4,133	3,394	82%	3,354	81%	3,375	82%
1946	4,133	3,795	92%	3,283	79%	3,557	86%
1947	4,133	1,697	41%	2,004	48%	1,839	45%
1948	4,133	3,256	79%	2,393	58%	2,854	69%
1949	4,133	1,387	34%	1,504	36%	1,441	35%
1950	4,133	2,738	66%	2,569	62%	2,660	64%
1951	4,133	4,133	100%	3,983	96%	4,063	98%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,164	77%	3,660	89%
1954	4,133	3,079	74%	2,795	68%	2,947	71%
1955	4,133	980	24%	967	23%	974	24%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	2,002	48%	2,247	54%
1958	4,133	4,133	100%	4,132	100%	4,133	100%
1959	4,133	3,219	78%	2,268	55%	2,777	67%
1960	4,133	1,557	38%	2,077	50%	1,799	44%
1961	4,133	2,746	66%	2,092	51%	2,442	59%
1962	4,133	3,016	73%	2,962	72%	2,991	72%
1963	4,133	3,923	95%	3,629	88%	3,786	92%
1964	4,133	1,605	39%	1,557	38%	1,583	38%
1965	4,133	3,368	81%	3,285	79%	3,329	81%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-4 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with A2 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,476	84%	2,984	72%	3,247	79%
1967	4,133	4,133	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,614	63%	2,814	68%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,971	96%	4,058	98%
1971	4,133	3,665	89%	3,456	84%	3,568	86%
1972	4,133	1,458	35%	1,563	38%	1,507	36%
1973	4,133	4,133	100%	3,571	86%	3,872	94%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,179	77%	3,417	83%
1976	4,133	2,167	52%	1,720	42%	1,959	47%
1977	4,133	287	7%	332	8%	308	7%
1978	3,898	3,905	94%	3,904	94%	3,905	94%
1979	4,133	3,292	80%	2,937	71%	3,127	76%
1980	3,898	3,766	91%	3,492	84%	3,639	88%
1981	4,133	2,737	66%	2,535	61%	2,643	64%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,025	97%	4,083	99%
1985	4,133	3,226	78%	2,518	61%	2,897	70%
1986	3,898	2,863	69%	2,957	72%	2,907	70%
1987	4,133	2,679	65%	2,551	62%	2,619	63%
1988	4,133	450	11%	628	15%	533	13%
1989	4,133	3,486	84%	3,060	74%	3,288	80%
1990	4,133	281	7%	514	12%	389	9%
1991	4,133	889	22%	869	21%	880	21%
1992	4,133	1,124	27%	1,091	26%	1,109	27%
1993	4,133	4,036	98%	3,989	97%	4,014	97%
1994	4,133	1,866	45%	1,193	29%	1,553	38%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,133	100%	3,653	88%	3,910	95%
1997	4,133	3,301	80%	3,235	78%	3,271	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,777	91%	3,967	96%
2000	4,133	3,960	96%	3,264	79%	3,636	88%
2001	4,133	769	19%	872	21%	817	20%
2002	4,133	2,586	63%	2,387	58%	2,493	60%
2003	4,133	3,213	78%	3,224	78%	3,218	78%
Avg	4,106	2,947	71%	2,729	66%	2,846	69%
Min	3,898	281	7%	332	8%	308	7%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-5 SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with A2 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		GFDL with A2 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	3,664	89%	3,597	87%	3,633	88%
1923	4,133	2,991	72%	2,312	56%	2,676	65%
1924	4,133	125	3%	437	11%	270	7%
1925	4,133	1,565	38%	1,350	33%	1,465	35%
1926	4,133	1,968	48%	1,727	42%	1,856	45%
1927	4,133	3,706	90%	3,688	89%	3,697	89%
1928	4,133	1,895	46%	1,754	42%	1,829	44%
1929	4,133	646	16%	702	17%	672	16%
1930	4,133	2,114	51%	2,461	60%	2,275	55%
1931	4,133	1,046	25%	804	19%	934	23%
1932	4,133	1,165	28%	1,350	33%	1,251	30%
1933	4,133	1,915	46%	885	21%	1,436	35%
1934	4,133	1,427	35%	1,315	32%	1,375	33%
1935	4,133	3,087	75%	2,933	71%	3,015	73%
1936	4,133	2,959	72%	3,552	86%	3,235	78%
1937	4,133	3,774	91%	2,391	58%	3,131	76%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,237	54%	2,730	66%
1940	4,133	3,136	76%	3,317	80%	3,220	78%
1941	3,898	3,798	92%	3,532	85%	3,674	89%
1942	4,133	3,626	88%	3,192	77%	3,424	83%
1943	4,133	3,466	84%	3,498	85%	3,481	84%
1944	4,133	2,550	62%	1,627	39%	2,121	51%
1945	4,133	3,315	80%	3,442	83%	3,374	82%
1946	4,133	3,430	83%	3,007	73%	3,233	78%
1947	4,133	1,819	44%	1,588	38%	1,711	41%
1948	4,133	2,891	70%	2,343	57%	2,636	64%
1949	4,133	1,096	27%	1,127	27%	1,110	27%
1950	4,133	2,232	54%	2,339	57%	2,282	55%
1951	4,133	4,133	100%	3,991	97%	4,067	98%
1952	3,898	3,907	95%	3,876	94%	3,893	94%
1953	4,133	3,163	77%	2,476	60%	2,843	69%
1954	4,133	3,034	73%	2,505	61%	2,788	67%
1955	4,133	998	24%	854	21%	931	23%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,770	43%	1,888	46%
1958	4,133	4,133	100%	3,627	88%	3,898	94%
1959	4,133	2,933	71%	2,399	58%	2,684	65%
1960	4,133	1,237	30%	1,680	41%	1,443	35%
1961	4,133	2,492	60%	2,077	50%	2,299	56%
1962	4,133	3,124	76%	2,927	71%	3,033	73%
1963	4,133	3,119	75%	2,835	69%	2,987	72%
1964	4,133	2,189	53%	1,864	45%	2,038	49%
1965	4,133	2,979	72%	3,041	74%	3,008	73%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-5 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with A2 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		GFDL with A2 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,376	82%	2,624	63%	3,026	73%
1967	4,133	4,047	98%	4,133	100%	4,087	99%
1968	4,133	2,368	57%	2,083	50%	2,235	54%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,645	88%	3,906	95%
1971	4,133	3,124	76%	3,117	75%	3,121	76%
1972	4,133	1,487	36%	1,463	35%	1,476	36%
1973	4,133	3,455	84%	2,916	71%	3,204	78%
1974	4,133	3,748	91%	3,850	93%	3,795	92%
1975	4,133	3,232	78%	2,602	63%	2,939	71%
1976	4,133	1,632	39%	1,866	45%	1,741	42%
1977	4,133	278	7%	279	7%	278	7%
1978	3,898	3,905	94%	3,904	94%	3,904	94%
1979	4,133	3,044	74%	2,635	64%	2,853	69%
1980	3,898	3,905	94%	3,584	87%	3,756	91%
1981	4,133	2,545	62%	2,298	56%	2,430	59%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,119	100%	4,127	100%
1985	4,133	3,030	73%	2,314	56%	2,697	65%
1986	3,898	2,841	69%	2,964	72%	2,898	70%
1987	4,133	2,280	55%	2,067	50%	2,181	53%
1988	4,133	427	10%	738	18%	572	14%
1989	4,133	3,197	77%	2,811	68%	3,017	73%
1990	4,133	191	5%	293	7%	238	6%
1991	4,133	733	18%	700	17%	718	17%
1992	4,133	1,100	27%	1,078	26%	1,090	26%
1993	4,133	3,504	85%	3,684	89%	3,588	87%
1994	4,133	2,283	55%	1,237	30%	1,797	43%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	3,383	82%	3,501	85%
1997	4,133	3,211	78%	3,344	81%	3,273	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,544	86%	3,859	93%
2000	4,133	3,316	80%	2,874	70%	3,110	75%
2001	4,133	982	24%	771	19%	884	21%
2002	4,133	2,063	50%	2,074	50%	2,068	50%
2003	4,133	2,836	69%	2,819	68%	2,828	68%
Avg	4,106	2,734	66%	2,540	61%	2,643	64%
Min	3,898	125	3%	279	7%	238	6%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-6 SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with B1 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		GFDL with B1 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	4,057	98%	3,945	95%	4,005	97%
1923	4,133	3,114	75%	2,000	48%	2,596	63%
1924	4,133	438	11%	797	19%	605	15%
1925	4,133	1,628	39%	1,455	35%	1,548	37%
1926	4,133	2,414	58%	1,893	46%	2,172	53%
1927	4,133	4,142	100%	3,772	91%	3,965	96%
1928	4,133	2,109	51%	2,098	51%	2,104	51%
1929	4,133	847	20%	997	24%	917	22%
1930	4,133	2,357	57%	2,055	50%	2,217	54%
1931	4,133	1,098	27%	1,099	27%	1,098	27%
1932	4,133	1,512	37%	1,367	33%	1,445	35%
1933	4,133	2,274	55%	1,219	29%	1,783	43%
1934	4,133	1,327	32%	1,452	35%	1,385	34%
1935	4,133	3,734	90%	3,366	81%	3,563	86%
1936	4,133	3,569	86%	3,125	76%	3,363	81%
1937	4,133	3,510	85%	2,225	54%	2,912	70%
1938	4,133	4,141	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,620	63%	3,105	75%
1940	4,133	3,642	88%	3,565	86%	3,606	87%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,141	100%	3,494	85%	3,836	93%
1943	4,133	3,849	93%	3,567	86%	3,718	90%
1944	4,133	2,924	71%	2,070	50%	2,527	61%
1945	4,133	3,394	82%	2,823	68%	3,128	76%
1946	4,133	3,795	92%	3,449	83%	3,634	88%
1947	4,133	1,697	41%	1,910	46%	1,796	43%
1948	4,133	3,256	79%	2,427	59%	2,870	69%
1949	4,133	1,387	34%	1,397	34%	1,392	34%
1950	4,133	2,738	66%	2,514	61%	2,634	64%
1951	4,133	4,143	100%	4,012	97%	4,077	99%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,136	76%	3,647	88%
1954	4,133	3,079	74%	2,965	72%	3,026	73%
1955	4,133	980	24%	954	23%	968	23%
1956	4,133	4,135	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	1,973	48%	2,234	54%
1958	4,133	4,134	100%	4,132	100%	4,133	100%
1959	4,133	3,219	78%	2,330	56%	2,805	68%
1960	4,133	1,557	38%	1,809	44%	1,674	41%
1961	4,133	2,746	66%	2,308	56%	2,542	62%
1962	4,133	3,016	73%	2,937	71%	2,979	72%
1963	4,133	3,923	95%	3,710	90%	3,824	93%
1964	4,133	1,605	39%	1,554	38%	1,581	38%
1965	4,133	3,368	81%	3,277	79%	3,326	80%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-6 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with B1 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		GFDL with B1 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,476	84%	2,895	70%	3,206	78%
1967	4,133	4,141	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,570	62%	2,794	68%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,137	100%	4,010	97%	4,076	99%
1971	4,133	3,665	89%	3,525	85%	3,600	87%
1972	4,133	1,458	35%	1,564	38%	1,507	36%
1973	4,133	4,135	100%	3,574	86%	3,873	94%
1974	4,133	4,133	100%	3,807	92%	3,981	96%
1975	4,133	3,624	88%	3,020	73%	3,343	81%
1976	4,133	2,167	52%	2,113	51%	2,142	52%
1977	4,133	287	7%	306	7%	296	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,292	80%	2,612	63%	2,976	72%
1980	3,898	3,766	91%	3,515	85%	3,649	88%
1981	4,133	2,737	66%	2,498	60%	2,626	64%
1982	4,133	4,143	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,134	100%	4,057	98%	4,098	99%
1985	4,133	3,226	78%	2,471	60%	2,875	70%
1986	3,898	2,863	69%	2,976	72%	2,915	71%
1987	4,133	2,679	65%	2,378	58%	2,539	61%
1988	4,133	450	11%	602	15%	521	13%
1989	4,133	3,486	84%	3,225	78%	3,365	81%
1990	4,133	281	7%	484	12%	376	9%
1991	4,133	889	22%	924	22%	905	22%
1992	4,133	1,124	27%	1,014	25%	1,073	26%
1993	4,133	4,036	98%	3,975	96%	4,007	97%
1994	4,133	1,866	45%	1,169	28%	1,542	37%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,143	100%	3,579	87%	3,875	94%
1997	4,133	3,301	80%	3,244	78%	3,275	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,141	100%	3,812	92%	3,984	96%
2000	4,133	3,960	96%	3,061	74%	3,542	86%
2001	4,133	769	19%	874	21%	818	20%
2002	4,133	2,586	63%	2,264	55%	2,436	59%
2003	4,133	3,213	78%	3,327	81%	3,266	79%
Avg	4,106	2,947	71%	2,696	65%	2,830	68%
Min	3,898	281	7%	306	7%	296	7%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-7 SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with B1 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		GFDL with B1 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	3,664	89%	3,556	86%	3,614	87%
1923	4,133	2,991	72%	2,293	55%	2,666	65%
1924	4,133	125	3%	301	7%	207	5%
1925	4,133	1,565	38%	1,363	33%	1,471	36%
1926	4,133	1,968	48%	1,561	38%	1,779	43%
1927	4,133	3,706	90%	3,632	88%	3,671	89%
1928	4,133	1,895	46%	1,757	43%	1,831	44%
1929	4,133	646	16%	768	19%	703	17%
1930	4,133	2,114	51%	2,048	50%	2,083	50%
1931	4,133	1,046	25%	889	22%	973	24%
1932	4,133	1,165	28%	1,352	33%	1,252	30%
1933	4,133	1,915	46%	892	22%	1,439	35%
1934	4,133	1,427	35%	1,181	29%	1,313	32%
1935	4,133	3,087	75%	2,839	69%	2,972	72%
1936	4,133	2,959	72%	2,894	70%	2,929	71%
1937	4,133	3,774	91%	2,132	52%	3,010	73%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,358	57%	2,786	67%
1940	4,133	3,136	76%	3,075	74%	3,108	75%
1941	3,898	3,798	92%	3,433	83%	3,628	88%
1942	4,133	3,626	88%	3,107	75%	3,384	82%
1943	4,133	3,466	84%	3,499	85%	3,481	84%
1944	4,133	2,550	62%	1,547	37%	2,083	50%
1945	4,133	3,315	80%	3,018	73%	3,177	77%
1946	4,133	3,430	83%	3,166	77%	3,307	80%
1947	4,133	1,819	44%	1,484	36%	1,663	40%
1948	4,133	2,891	70%	2,426	59%	2,675	65%
1949	4,133	1,096	27%	1,085	26%	1,090	26%
1950	4,133	2,232	54%	2,162	52%	2,200	53%
1951	4,133	4,133	100%	3,928	95%	4,038	98%
1952	3,898	3,907	95%	3,841	93%	3,876	94%
1953	4,133	3,163	77%	2,539	61%	2,872	70%
1954	4,133	3,034	73%	2,683	65%	2,871	69%
1955	4,133	998	24%	838	20%	924	22%
1956	4,133	4,133	100%	4,040	98%	4,090	99%
1957	4,133	1,991	48%	1,796	43%	1,900	46%
1958	4,133	4,133	100%	3,720	90%	3,941	95%
1959	4,133	2,933	71%	2,347	57%	2,660	64%
1960	4,133	1,237	30%	1,291	31%	1,263	31%
1961	4,133	2,492	60%	2,313	56%	2,409	58%
1962	4,133	3,124	76%	2,786	67%	2,967	72%
1963	4,133	3,119	75%	3,101	75%	3,111	75%
1964	4,133	2,189	53%	1,676	41%	1,951	47%
1965	4,133	2,979	72%	3,063	74%	3,018	73%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-7 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with GFDL Model with B1 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		GFDL with B1 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,376	82%	2,551	62%	2,992	72%
1967	4,133	4,047	98%	4,006	97%	4,028	97%
1968	4,133	2,368	57%	2,121	51%	2,253	55%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,736	90%	3,948	96%
1971	4,133	3,124	76%	3,117	75%	3,121	76%
1972	4,133	1,487	36%	1,460	35%	1,475	36%
1973	4,133	3,455	84%	2,949	71%	3,219	78%
1974	4,133	3,748	91%	3,622	88%	3,689	89%
1975	4,133	3,232	78%	2,665	64%	2,968	72%
1976	4,133	1,632	39%	1,969	48%	1,789	43%
1977	4,133	278	7%	280	7%	279	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,044	74%	2,117	51%	2,613	63%
1980	3,898	3,905	94%	3,622	88%	3,773	91%
1981	4,133	2,545	62%	1,974	48%	2,280	55%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,013	97%	4,078	99%
1985	4,133	3,030	73%	2,281	55%	2,681	65%
1986	3,898	2,841	69%	3,046	74%	2,936	71%
1987	4,133	2,280	55%	1,865	45%	2,087	50%
1988	4,133	427	10%	689	17%	549	13%
1989	4,133	3,197	77%	3,064	74%	3,135	76%
1990	4,133	191	5%	198	5%	194	5%
1991	4,133	733	18%	681	16%	709	17%
1992	4,133	1,100	27%	1,010	24%	1,058	26%
1993	4,133	3,504	85%	3,614	87%	3,555	86%
1994	4,133	2,283	55%	1,154	28%	1,758	43%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	2,991	72%	3,319	80%
1997	4,133	3,211	78%	3,352	81%	3,276	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,348	81%	3,768	91%
2000	4,133	3,316	80%	2,900	70%	3,123	76%
2001	4,133	982	24%	635	15%	821	20%
2002	4,133	2,063	50%	2,064	50%	2,063	50%
2003	4,133	2,836	69%	2,879	70%	2,856	69%
Avg	4,106	2,734	66%	2,482	60%	2,617	63%
Min	3,898	125	3%	198	5%	194	5%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-8 SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with A2 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		PCM with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	4,057	98%	4,062	98%	4,060	98%
1923	4,133	3,114	75%	2,377	58%	2,771	67%
1924	4,133	438	11%	568	14%	498	12%
1925	4,133	1,628	39%	1,473	36%	1,556	38%
1926	4,133	2,414	58%	1,907	46%	2,178	53%
1927	4,133	4,142	100%	4,107	99%	4,121	100%
1928	4,133	2,109	51%	1,909	46%	2,016	49%
1929	4,133	847	20%	970	23%	904	22%
1930	4,133	2,357	57%	1,974	48%	2,179	53%
1931	4,133	1,098	27%	1,164	28%	1,128	27%
1932	4,133	1,512	37%	1,353	33%	1,438	35%
1933	4,133	2,274	55%	1,378	33%	1,857	45%
1934	4,133	1,327	32%	1,381	33%	1,352	33%
1935	4,133	3,734	90%	3,527	85%	3,638	88%
1936	4,133	3,569	86%	3,562	86%	3,566	86%
1937	4,133	3,510	85%	2,518	61%	3,049	74%
1938	4,133	4,141	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,997	73%	3,280	79%
1940	4,133	3,642	88%	3,834	93%	3,731	90%
1941	3,898	3,908	95%	3,906	95%	3,907	95%
1942	4,133	4,141	100%	3,805	92%	3,981	96%
1943	4,133	3,849	93%	3,587	87%	3,727	90%
1944	4,133	2,924	71%	2,058	50%	2,521	61%
1945	4,133	3,394	82%	3,896	94%	3,627	88%
1946	4,133	3,795	92%	3,080	75%	3,463	84%
1947	4,133	1,697	41%	1,704	41%	1,700	41%
1948	4,133	3,256	79%	2,786	67%	3,037	73%
1949	4,133	1,387	34%	1,370	33%	1,379	33%
1950	4,133	2,738	66%	2,810	68%	2,771	67%
1951	4,133	4,143	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,373	82%	3,757	91%
1954	4,133	3,079	74%	2,962	72%	3,025	73%
1955	4,133	980	24%	929	22%	956	23%
1956	4,133	4,135	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	1,945	47%	2,221	54%
1958	4,133	4,134	100%	4,133	100%	4,133	100%
1959	4,133	3,219	78%	2,489	60%	2,880	70%
1960	4,133	1,557	38%	1,874	45%	1,705	41%
1961	4,133	2,746	66%	2,627	64%	2,691	65%
1962	4,133	3,016	73%	2,902	70%	2,963	72%
1963	4,133	3,923	95%	3,687	89%	3,813	92%
1964	4,133	1,605	39%	1,535	37%	1,572	38%
1965	4,133	3,368	81%	3,225	78%	3,301	80%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-8 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with A2 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		PCM with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,476	84%	3,208	78%	3,352	81%
1967	4,133	4,141	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,743	66%	2,874	70%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,137	100%	4,133	100%	4,133	100%
1971	4,133	3,665	89%	3,452	84%	3,566	86%
1972	4,133	1,458	35%	1,422	34%	1,441	35%
1973	4,133	4,135	100%	3,758	91%	3,959	96%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,404	82%	3,521	85%
1976	4,133	2,167	52%	2,000	48%	2,089	51%
1977	4,133	287	7%	274	7%	281	7%
1978	3,898	3,905	94%	3,903	94%	3,904	94%
1979	4,133	3,292	80%	3,056	74%	3,182	77%
1980	3,898	3,766	91%	3,491	84%	3,638	88%
1981	4,133	2,737	66%	2,570	62%	2,659	64%
1982	4,133	4,143	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,134	100%	4,133	100%	4,133	100%
1985	4,133	3,226	78%	2,581	62%	2,926	71%
1986	3,898	2,863	69%	3,004	73%	2,928	71%
1987	4,133	2,679	65%	2,567	62%	2,627	64%
1988	4,133	450	11%	446	11%	448	11%
1989	4,133	3,486	84%	3,424	83%	3,457	84%
1990	4,133	281	7%	377	9%	325	8%
1991	4,133	889	22%	875	21%	883	21%
1992	4,133	1,124	27%	1,090	26%	1,108	27%
1993	4,133	4,036	98%	4,057	98%	4,046	98%
1994	4,133	1,866	45%	1,494	36%	1,693	41%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,143	100%	3,813	92%	3,984	96%
1997	4,133	3,301	80%	3,199	77%	3,254	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,141	100%	3,960	96%	4,052	98%
2000	4,133	3,960	96%	3,602	87%	3,794	92%
2001	4,133	769	19%	824	20%	795	19%
2002	4,133	2,586	63%	1,996	48%	2,312	56%
2003	4,133	3,213	78%	3,241	78%	3,226	78%
Avg	4,106	2,947	71%	2,782	67%	2,870	69%
Min	3,898	281	7%	274	7%	281	7%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-9 SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with A2 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		PCM with A2 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	3,664	89%	3,545	86%	3,609	87%
1923	4,133	2,991	72%	2,850	69%	2,925	71%
1924	4,133	125	3%	150	4%	137	3%
1925	4,133	1,565	38%	1,394	34%	1,485	36%
1926	4,133	1,968	48%	1,463	35%	1,733	42%
1927	4,133	3,706	90%	3,736	90%	3,720	90%
1928	4,133	1,895	46%	1,701	41%	1,805	44%
1929	4,133	646	16%	712	17%	677	16%
1930	4,133	2,114	51%	1,849	45%	1,991	48%
1931	4,133	1,046	25%	1,051	25%	1,049	25%
1932	4,133	1,165	28%	1,286	31%	1,222	30%
1933	4,133	1,915	46%	1,172	28%	1,569	38%
1934	4,133	1,427	35%	1,264	31%	1,351	33%
1935	4,133	3,087	75%	3,437	83%	3,250	79%
1936	4,133	2,959	72%	3,265	79%	3,101	75%
1937	4,133	3,774	91%	2,662	64%	3,257	79%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,727	66%	2,958	72%
1940	4,133	3,136	76%	3,226	78%	3,178	77%
1941	3,898	3,798	92%	3,826	93%	3,811	92%
1942	4,133	3,626	88%	3,421	83%	3,531	85%
1943	4,133	3,466	84%	3,754	91%	3,600	87%
1944	4,133	2,550	62%	1,272	31%	1,955	47%
1945	4,133	3,315	80%	4,000	97%	3,634	88%
1946	4,133	3,430	83%	2,729	66%	3,104	75%
1947	4,133	1,819	44%	1,441	35%	1,643	40%
1948	4,133	2,891	70%	2,535	61%	2,726	66%
1949	4,133	1,096	27%	1,068	26%	1,083	26%
1950	4,133	2,232	54%	1,992	48%	2,120	51%
1951	4,133	4,133	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,906	95%	3,906	95%
1953	4,133	3,163	77%	2,660	64%	2,929	71%
1954	4,133	3,034	73%	2,938	71%	2,989	72%
1955	4,133	998	24%	676	16%	848	21%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,760	43%	1,883	46%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	2,933	71%	2,481	60%	2,722	66%
1960	4,133	1,237	30%	1,522	37%	1,370	33%
1961	4,133	2,492	60%	2,162	52%	2,339	57%
1962	4,133	3,124	76%	3,127	76%	3,126	76%
1963	4,133	3,119	75%	3,065	74%	3,094	75%
1964	4,133	2,189	53%	1,582	38%	1,907	46%
1965	4,133	2,979	72%	2,955	72%	2,968	72%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-9 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with A2 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		PCM with A2 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,376	82%	2,891	70%	3,150	76%
1967	4,133	4,047	98%	4,110	99%	4,077	99%
1968	4,133	2,368	57%	2,085	50%	2,236	54%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,124	76%	3,090	75%	3,108	75%
1972	4,133	1,487	36%	1,408	34%	1,450	35%
1973	4,133	3,455	84%	3,275	79%	3,371	82%
1974	4,133	3,748	91%	3,684	89%	3,718	90%
1975	4,133	3,232	78%	3,000	73%	3,124	76%
1976	4,133	1,632	39%	1,558	38%	1,598	39%
1977	4,133	278	7%	248	6%	264	6%
1978	3,898	3,905	94%	3,904	94%	3,904	94%
1979	4,133	3,044	74%	2,768	67%	2,915	71%
1980	3,898	3,905	94%	3,893	94%	3,899	94%
1981	4,133	2,545	62%	2,169	52%	2,370	57%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,030	73%	2,420	59%	2,746	66%
1986	3,898	2,841	69%	3,253	79%	3,032	73%
1987	4,133	2,280	55%	1,709	41%	2,014	49%
1988	4,133	427	10%	636	15%	524	13%
1989	4,133	3,197	77%	3,184	77%	3,191	77%
1990	4,133	191	5%	177	4%	184	4%
1991	4,133	733	18%	626	15%	683	17%
1992	4,133	1,100	27%	1,047	25%	1,075	26%
1993	4,133	3,504	85%	3,554	86%	3,527	85%
1994	4,133	2,283	55%	1,372	33%	1,859	45%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	3,661	89%	3,631	88%
1997	4,133	3,211	78%	3,287	80%	3,246	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	4,112	99%	4,123	100%
2000	4,133	3,316	80%	3,237	78%	3,279	79%
2001	4,133	982	24%	617	15%	812	20%
2002	4,133	2,063	50%	1,845	45%	1,961	47%
2003	4,133	2,836	69%	2,831	69%	2,834	69%
Avg	4,106	2,734	66%	2,592	63%	2,668	65%
Min	3,898	125	3%	150	4%	137	3%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-10 SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with B1 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		PCM with B1 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	4,057	98%	4,132	100%	4,092	99%
1923	4,133	3,114	75%	3,064	74%	3,091	75%
1924	4,133	438	11%	295	7%	371	9%
1925	4,133	1,628	39%	1,821	44%	1,718	42%
1926	4,133	2,414	58%	2,070	50%	2,254	55%
1927	4,133	4,142	100%	4,032	98%	4,086	99%
1928	4,133	2,109	51%	2,273	55%	2,186	53%
1929	4,133	847	20%	1,058	26%	945	23%
1930	4,133	2,357	57%	2,233	54%	2,299	56%
1931	4,133	1,098	27%	1,167	28%	1,130	27%
1932	4,133	1,512	37%	1,638	40%	1,570	38%
1933	4,133	2,274	55%	2,415	58%	2,340	57%
1934	4,133	1,327	32%	1,323	32%	1,325	32%
1935	4,133	3,734	90%	3,831	93%	3,779	91%
1936	4,133	3,569	86%	3,649	88%	3,606	87%
1937	4,133	3,510	85%	3,137	76%	3,337	81%
1938	4,133	4,141	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	3,283	79%	3,414	83%
1940	4,133	3,642	88%	3,929	95%	3,775	91%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,141	100%	4,133	100%	4,133	100%
1943	4,133	3,849	93%	3,682	89%	3,772	91%
1944	4,133	2,924	71%	2,964	72%	2,943	71%
1945	4,133	3,394	82%	3,743	91%	3,556	86%
1946	4,133	3,795	92%	3,494	85%	3,655	88%
1947	4,133	1,697	41%	1,817	44%	1,752	42%
1948	4,133	3,256	79%	3,345	81%	3,297	80%
1949	4,133	1,387	34%	1,559	38%	1,467	35%
1950	4,133	2,738	66%	2,896	70%	2,812	68%
1951	4,133	4,143	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,727	90%	3,922	95%
1954	4,133	3,079	74%	3,306	80%	3,184	77%
1955	4,133	980	24%	1,074	26%	1,024	25%
1956	4,133	4,135	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	2,424	59%	2,443	59%
1958	4,133	4,134	100%	4,133	100%	4,133	100%
1959	4,133	3,219	78%	3,175	77%	3,199	77%
1960	4,133	1,557	38%	1,911	46%	1,722	42%
1961	4,133	2,746	66%	2,540	61%	2,650	64%
1962	4,133	3,016	73%	3,519	85%	3,250	79%
1963	4,133	3,923	95%	3,314	80%	3,640	88%
1964	4,133	1,605	39%	2,055	50%	1,814	44%
1965	4,133	3,368	81%	3,325	80%	3,348	81%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-10 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with B1 Emissions and less restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Lower flow target scenario[1]		PCM with B1 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,476	84%	3,497	85%	3,486	84%
1967	4,133	4,141	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,991	72%	2,990	72%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,137	100%	4,133	100%	4,133	100%
1971	4,133	3,665	89%	3,651	88%	3,658	89%
1972	4,133	1,458	35%	1,525	37%	1,489	36%
1973	4,133	4,135	100%	3,847	93%	4,000	97%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,776	91%	3,695	89%
1976	4,133	2,167	52%	2,296	56%	2,227	54%
1977	4,133	287	7%	315	8%	300	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,292	80%	3,462	84%	3,371	82%
1980	3,898	3,766	91%	3,596	87%	3,687	89%
1981	4,133	2,737	66%	2,745	66%	2,740	66%
1982	4,133	4,143	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,134	100%	4,133	100%	4,133	100%
1985	4,133	3,226	78%	3,369	82%	3,293	80%
1986	3,898	2,863	69%	2,726	66%	2,799	68%
1987	4,133	2,679	65%	2,520	61%	2,605	63%
1988	4,133	450	11%	521	13%	483	12%
1989	4,133	3,486	84%	3,526	85%	3,504	85%
1990	4,133	281	7%	466	11%	367	9%
1991	4,133	889	22%	1,052	25%	965	23%
1992	4,133	1,124	27%	1,380	33%	1,243	30%
1993	4,133	4,036	98%	3,943	95%	3,993	97%
1994	4,133	1,866	45%	1,884	46%	1,874	45%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,143	100%	3,893	94%	4,021	97%
1997	4,133	3,301	80%	3,285	79%	3,294	80%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,141	100%	4,068	98%	4,103	99%
2000	4,133	3,960	96%	3,858	93%	3,913	95%
2001	4,133	769	19%	1,017	25%	884	21%
2002	4,133	2,586	63%	2,605	63%	2,595	63%
2003	4,133	3,213	78%	3,188	77%	3,201	77%
Avg	4,106	2,947	71%	2,962	72%	2,954	71%
Min	3,898	281	7%	295	7%	300	7%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-11 SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with B1 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		PCM with B1 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1922	4,133	3,664	89%	3,626	88%	3,647	88%
1923	4,133	2,991	72%	3,082	75%	3,033	73%
1924	4,133	125	3%	178	4%	150	4%
1925	4,133	1,565	38%	1,789	43%	1,669	40%
1926	4,133	1,968	48%	1,966	48%	1,967	48%
1927	4,133	3,706	90%	3,650	88%	3,680	89%
1928	4,133	1,895	46%	1,952	47%	1,921	46%
1929	4,133	646	16%	824	20%	729	18%
1930	4,133	2,114	51%	1,886	46%	2,008	49%
1931	4,133	1,046	25%	1,140	28%	1,090	26%
1932	4,133	1,165	28%	1,457	35%	1,301	31%
1933	4,133	1,915	46%	1,979	48%	1,944	47%
1934	4,133	1,427	35%	1,343	32%	1,388	34%
1935	4,133	3,087	75%	3,170	77%	3,126	76%
1936	4,133	2,959	72%	3,222	78%	3,081	75%
1937	4,133	3,774	91%	3,385	82%	3,593	87%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,893	70%	3,035	73%
1940	4,133	3,136	76%	3,327	81%	3,225	78%
1941	3,898	3,798	92%	3,887	94%	3,839	93%
1942	4,133	3,626	88%	3,653	88%	3,639	88%
1943	4,133	3,466	84%	3,547	86%	3,503	85%
1944	4,133	2,550	62%	2,449	59%	2,503	61%
1945	4,133	3,315	80%	3,641	88%	3,467	84%
1946	4,133	3,430	83%	3,288	80%	3,364	81%
1947	4,133	1,819	44%	1,907	46%	1,860	45%
1948	4,133	2,891	70%	2,837	69%	2,866	69%
1949	4,133	1,096	27%	1,417	34%	1,245	30%
1950	4,133	2,232	54%	2,726	66%	2,462	60%
1951	4,133	4,133	100%	3,757	91%	3,958	96%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	3,163	77%	3,050	74%	3,110	75%
1954	4,133	3,034	73%	3,080	75%	3,056	74%
1955	4,133	998	24%	1,053	25%	1,024	25%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,959	47%	1,976	48%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	2,933	71%	2,962	72%	2,946	71%
1960	4,133	1,237	30%	1,651	40%	1,430	35%
1961	4,133	2,492	60%	2,312	56%	2,408	58%
1962	4,133	3,124	76%	3,230	78%	3,174	77%
1963	4,133	3,119	75%	2,936	71%	3,034	73%
1964	4,133	2,189	53%	2,240	54%	2,213	54%
1965	4,133	2,979	72%	2,774	67%	2,884	70%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-11 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions with PCM Model with B1 Emissions and more restrictive Old and Middle River flow targets

Year	Table A Demand	No Climate Change Higher flow target scenario[1]		PCM with B1 Emissions Higher flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]	Table A Delivery (taf)	Percent of Maximum Table A[3]
1966	4,133	3,376	82%	3,376	82%	3,376	82%
1967	4,133	4,047	98%	4,050	98%	4,048	98%
1968	4,133	2,368	57%	2,357	57%	2,363	57%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,124	76%	3,149	76%	3,136	76%
1972	4,133	1,487	36%	1,503	36%	1,495	36%
1973	4,133	3,455	84%	3,381	82%	3,420	83%
1974	4,133	3,748	91%	3,837	93%	3,789	92%
1975	4,133	3,232	78%	3,211	78%	3,222	78%
1976	4,133	1,632	39%	1,631	39%	1,631	39%
1977	4,133	278	7%	284	7%	281	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,044	74%	3,002	73%	3,024	73%
1980	3,898	3,905	94%	3,855	93%	3,881	94%
1981	4,133	2,545	62%	2,549	62%	2,547	62%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,030	73%	3,035	73%	3,032	73%
1986	3,898	2,841	69%	2,775	67%	2,810	68%
1987	4,133	2,280	55%	2,379	58%	2,326	56%
1988	4,133	427	10%	484	12%	454	11%
1989	4,133	3,197	77%	3,351	81%	3,269	79%
1990	4,133	191	5%	449	11%	311	8%
1991	4,133	733	18%	826	20%	776	19%
1992	4,133	1,100	27%	1,152	28%	1,124	27%
1993	4,133	3,504	85%	3,434	83%	3,471	84%
1994	4,133	2,283	55%	2,228	54%	2,258	55%
1995	3,898	3,902	94%	3,903	94%	3,902	94%
1996	4,133	3,604	87%	3,647	88%	3,624	88%
1997	4,133	3,211	78%	3,380	82%	3,289	80%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	4,133	100%	4,133	100%
2000	4,133	3,316	80%	3,408	82%	3,359	81%
2001	4,133	982	24%	1,050	25%	1,014	25%
2002	4,133	2,063	50%	2,176	53%	2,115	51%
2003	4,133	2,836	69%	2,803	68%	2,820	68%
Avg	4,106	2,734	66%	2,760	67%	2,746	66%
Min	3,898	125	3%	178	4%	150	4%
Max	4,133	4,133	100%	4,133	100%	4,133	100%

1/ See Table 6-3 2/ As described in Appendix B 3/ 4,133 taf/year

Table B-12 SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability curve
Scenario: GFDL Model with A2 emissions

Deliveries derived from Interpolating between "No Climate Change" and "GFDL + A2 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1922	4,062	3,633	3,848	93%	0%	1938	4,133	100%
1923	2,622	2,676	2,649	64%	1%	1956	4,133	100%
1924	583	270	427	10%	3%	1982	4,133	100%
1925	1,554	1,465	1,510	37%	4%	1967	4,110	99%
1926	2,291	1,856	2,074	50%	5%	1984	4,105	99%
1927	3,986	3,697	3,842	93%	6%	1951	4,065	98%
1928	2,133	1,829	1,981	48%	8%	1958	4,015	97%
1929	863	672	767	19%	9%	1970	3,982	96%
1930	2,410	2,275	2,343	57%	10%	1974	3,964	96%
1931	1,083	934	1,008	24%	11%	1999	3,913	95%
1932	1,437	1,251	1,344	33%	12%	1998	3,908	95%
1933	1,847	1,436	1,641	40%	14%	1978	3,905	94%
1934	1,320	1,375	1,348	33%	15%	1969	3,903	94%
1935	3,488	3,015	3,252	79%	16%	1983	3,903	94%
1936	3,622	3,235	3,428	83%	17%	1995	3,903	94%
1937	2,943	3,131	3,037	73%	19%	1952	3,900	94%
1938	4,133	4,133	4,133	100%	20%	1922	3,848	93%
1939	3,044	2,730	2,887	70%	21%	1927	3,842	93%
1940	3,691	3,220	3,456	84%	22%	1993	3,801	92%
1941	3,907	3,674	3,791	92%	24%	1941	3,791	92%
1942	3,900	3,424	3,662	89%	25%	1996	3,705	90%
1943	3,703	3,481	3,592	87%	26%	1980	3,697	89%
1944	2,555	2,121	2,338	57%	27%	1942	3,662	89%
1945	3,375	3,374	3,375	82%	28%	1943	3,592	87%
1946	3,557	3,233	3,395	82%	30%	1973	3,538	86%
1947	1,839	1,711	1,775	43%	31%	1940	3,456	84%
1948	2,854	2,636	2,745	66%	32%	1936	3,428	83%
1949	1,441	1,110	1,276	31%	33%	1946	3,395	82%
1950	2,660	2,282	2,471	60%	35%	1963	3,387	82%
1951	4,063	4,067	4,065	98%	36%	1945	3,375	82%
1952	3,907	3,893	3,900	94%	37%	2000	3,373	82%
1953	3,660	2,843	3,252	79%	38%	1971	3,344	81%
1954	2,947	2,788	2,867	69%	40%	1997	3,272	79%
1955	974	931	952	23%	41%	1953	3,252	79%
1956	4,133	4,133	4,133	100%	42%	1935	3,252	79%
1957	2,247	1,888	2,068	50%	43%	1975	3,178	77%
1958	4,133	3,898	4,015	97%	45%	1965	3,169	77%
1959	2,777	2,684	2,731	66%	46%	1989	3,153	76%
1960	1,799	1,443	1,621	39%	47%	1966	3,137	76%
1961	2,442	2,299	2,371	57%	48%	1937	3,037	73%
1962	2,991	3,033	3,012	73%	49%	2003	3,023	73%
1963	3,786	2,987	3,387	82%	51%	1962	3,012	73%
1964	1,583	2,038	1,810	44%	52%	1979	2,990	72%
1965	3,329	3,008	3,169	77%	53%	1986	2,902	70%

1 / See Table 6-3 2/ 4,133 taf/year

Table B-12 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability curve
Scenario: GFDL Model with A2 emissions

Deliveries derived from Interpolating between "No Climate Change" and "GFDL + A2 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1966	3,247	3,026	3,137	76%	54%	1939	2,887	70%
1967	4,133	4,087	4,110	99%	56%	1954	2,867	69%
1968	2,814	2,235	2,525	61%	57%	1985	2,797	68%
1969	3,903	3,903	3,903	94%	58%	1948	2,745	66%
1970	4,058	3,906	3,982	96%	59%	1959	2,731	66%
1971	3,568	3,121	3,344	81%	61%	1923	2,649	64%
1972	1,507	1,476	1,491	36%	62%	1981	2,536	61%
1973	3,872	3,204	3,538	86%	63%	1968	2,525	61%
1974	4,133	3,795	3,964	96%	64%	1950	2,471	60%
1975	3,417	2,939	3,178	77%	66%	1987	2,400	58%
1976	1,959	1,741	1,850	45%	67%	1961	2,371	57%
1977	308	278	293	7%	68%	1930	2,343	57%
1978	3,905	3,904	3,905	94%	69%	1944	2,338	57%
1979	3,127	2,853	2,990	72%	70%	2002	2,281	55%
1980	3,639	3,756	3,697	89%	72%	1926	2,074	50%
1981	2,643	2,430	2,536	61%	73%	1957	2,068	50%
1982	4,133	4,133	4,133	100%	74%	1928	1,981	48%
1983	3,903	3,903	3,903	94%	75%	1976	1,850	45%
1984	4,083	4,127	4,105	99%	77%	1964	1,810	44%
1985	2,897	2,697	2,797	68%	78%	1947	1,775	43%
1986	2,907	2,898	2,902	70%	79%	1994	1,675	41%
1987	2,619	2,181	2,400	58%	80%	1933	1,641	40%
1988	533	572	552	13%	82%	1960	1,621	39%
1989	3,288	3,017	3,153	76%	83%	1925	1,510	37%
1990	389	238	314	8%	84%	1972	1,491	36%
1991	880	718	799	19%	85%	1934	1,348	33%
1992	1,109	1,090	1,099	27%	87%	1932	1,344	33%
1993	4,014	3,588	3,801	92%	88%	1949	1,276	31%
1994	1,553	1,797	1,675	41%	89%	1992	1,099	27%
1995	3,903	3,903	3,903	94%	90%	1931	1,008	24%
1996	3,910	3,501	3,705	90%	91%	1955	952	23%
1997	3,271	3,273	3,272	79%	93%	2001	850	21%
1998	3,908	3,908	3,908	95%	94%	1991	799	19%
1999	3,967	3,859	3,913	95%	95%	1929	767	19%
2000	3,636	3,110	3,373	82%	96%	1988	552	13%
2001	817	884	850	21%	98%	1924	427	10%
2002	2,493	2,068	2,281	55%	99%	1990	314	8%
2003	3,218	2,828	3,023	73%	100%	1977	293	7%
Avg	2,846	2,643	2,745	66%			2,745	
Min	308	238	293	7%			293	
Max	4,133	4,133	4,133	100%			4,133	

1 / See Table 6-3 2/ 4,133 taf/year

Table B-13 SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability cure
Scenario: GFDL Model with B1 emissions

Deliveries derived from Interpolating between "No Climate Change" and "GFDL + B1 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1922	4,005	3,614	3,810	92%	0%	1938	4,133	100%
1923	2,596	2,666	2,631	64%	1%	1956	4,133	100%
1924	605	207	406	10%	3%	1982	4,111	99%
1925	1,548	1,471	1,509	37%	4%	1984	4,088	99%
1926	2,172	1,779	1,975	48%	5%	1967	4,081	99%
1927	3,965	3,671	3,818	92%	6%	1951	4,057	98%
1928	2,104	1,831	1,967	48%	8%	1958	4,037	98%
1929	917	703	810	20%	9%	1970	4,012	97%
1930	2,217	2,083	2,150	52%	10%	1998	3,908	95%
1931	1,098	973	1,036	25%	11%	1978	3,905	94%
1932	1,445	1,252	1,348	33%	12%	1969	3,903	94%
1933	1,783	1,439	1,611	39%	14%	1983	3,903	94%
1934	1,385	1,313	1,349	33%	15%	1995	3,903	94%
1935	3,563	2,972	3,267	79%	16%	1952	3,892	94%
1936	3,363	2,929	3,146	76%	17%	1999	3,876	94%
1937	2,912	3,010	2,961	72%	19%	1974	3,835	93%
1938	4,133	4,133	4,133	100%	20%	1927	3,818	92%
1939	3,105	2,786	2,945	71%	21%	1922	3,810	92%
1940	3,606	3,108	3,357	81%	22%	1993	3,781	91%
1941	3,907	3,628	3,768	91%	24%	1941	3,768	91%
1942	3,836	3,384	3,610	87%	25%	1980	3,711	90%
1943	3,718	3,481	3,600	87%	26%	1942	3,610	87%
1944	2,527	2,083	2,305	56%	27%	1996	3,600	87%
1945	3,128	3,177	3,152	76%	28%	1943	3,597	87%
1946	3,634	3,307	3,471	84%	30%	1973	3,546	86%
1947	1,796	1,663	1,729	42%	31%	1946	3,471	84%
1948	2,870	2,675	2,773	67%	32%	1963	3,467	84%
1949	1,392	1,090	1,241	30%	33%	1971	3,361	81%
1950	2,634	2,200	2,417	58%	35%	1940	3,357	81%
1951	4,077	4,038	4,057	98%	36%	2000	3,332	81%
1952	3,907	3,876	3,892	94%	37%	1997	3,276	79%
1953	3,647	2,872	3,260	79%	38%	1935	3,267	79%
1954	3,026	2,871	2,949	71%	40%	1953	3,260	79%
1955	968	924	946	23%	41%	1989	3,250	79%
1956	4,133	4,090	4,111	99%	42%	1965	3,172	77%
1957	2,234	1,900	2,067	50%	43%	1975	3,156	76%
1958	4,133	3,941	4,037	98%	45%	1945	3,152	76%
1959	2,805	2,660	2,733	66%	46%	1936	3,146	76%
1960	1,674	1,263	1,468	36%	47%	1966	3,099	75%
1961	2,542	2,409	2,476	60%	48%	2003	3,061	74%
1962	2,979	2,967	2,973	72%	49%	1962	2,973	72%
1963	3,824	3,111	3,467	84%	51%	1937	2,961	72%
1964	1,581	1,951	1,766	43%	52%	1954	2,949	71%
1965	3,326	3,018	3,172	77%	53%	1939	2,945	71%

1 / See Table 6-3   2/ 4,133 taf/year

Table B-13 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions Derived values for estimating probability cure Scenario: GFDL Model with B1 emissions

Deliveries derived from Interpolating between "No Climate Change" and "GFDL + B1 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1966	3,206	2,992	3,099	75%	54%	1986	2,926	71%
1967	4,133	4,028	4,081	99%	56%	1979	2,794	68%
1968	2,794	2,253	2,523	61%	57%	1985	2,778	67%
1969	3,903	3,903	3,903	94%	58%	1948	2,773	67%
1970	4,076	3,948	4,012	97%	59%	1959	2,733	66%
1971	3,600	3,121	3,361	81%	61%	1923	2,631	64%
1972	1,507	1,475	1,491	36%	62%	1968	2,523	61%
1973	3,873	3,219	3,546	86%	63%	1961	2,476	60%
1974	3,981	3,689	3,835	93%	64%	1981	2,453	59%
1975	3,343	2,968	3,156	76%	66%	1950	2,417	58%
1976	2,142	1,789	1,965	48%	67%	1987	2,313	56%
1977	296	279	287	7%	68%	1944	2,305	56%
1978	3,905	3,905	3,905	94%	69%	2002	2,250	54%
1979	2,976	2,613	2,794	68%	70%	1930	2,150	52%
1980	3,649	3,773	3,711	90%	72%	1957	2,067	50%
1981	2,626	2,280	2,453	59%	73%	1926	1,975	48%
1982	4,133	4,133	4,133	100%	74%	1928	1,967	48%
1983	3,903	3,903	3,903	94%	75%	1976	1,965	48%
1984	4,098	4,077	4,088	99%	77%	1964	1,766	43%
1985	2,875	2,681	2,778	67%	78%	1947	1,729	42%
1986	2,915	2,936	2,926	71%	79%	1994	1,650	40%
1987	2,539	2,087	2,313	56%	80%	1933	1,611	39%
1988	521	549	535	13%	82%	1925	1,509	37%
1989	3,365	3,135	3,250	79%	83%	1972	1,491	36%
1990	376	194	285	7%	84%	1960	1,468	36%
1991	905	709	807	20%	85%	1934	1,349	33%
1992	1,073	1,058	1,065	26%	87%	1932	1,348	33%
1993	4,007	3,555	3,781	91%	88%	1949	1,241	30%
1994	1,542	1,758	1,650	40%	89%	1992	1,065	26%
1995	3,903	3,903	3,903	94%	90%	1931	1,036	25%
1996	3,875	3,319	3,597	87%	91%	1955	946	23%
1997	3,275	3,276	3,276	79%	93%	2001	819	20%
1998	3,908	3,908	3,908	95%	94%	1929	810	20%
1999	3,984	3,768	3,876	94%	95%	1991	807	20%
2000	3,542	3,123	3,332	81%	96%	1988	535	13%
2001	818	821	819	20%	98%	1924	406	10%
2002	2,436	2,063	2,250	54%	99%	1977	287	7%
2003	3,266	2,856	3,061	74%	100%	1990	285	7%
Avg	2,830	2,617	2,723	66%			2,723	
Min	296	194	285	7%			285	
Max	4,133	4,133	4,133	100%			4,133	

1 / See Table 6-3   2/ 4,133 taf/year

Table B-14 SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability curve
Scenario: PCM Model with A2 emissions

Deliveries derived from Interpolating between "No Climate Change" and "PCM + A2 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1922	4,060	3,609	3,834	93%	0%	1938	4,133	100%
1923	2,771	2,925	2,848	69%	1%	1951	4,133	100%
1924	498	137	317	8%	3%	1956	4,133	100%
1925	1,556	1,485	1,521	37%	4%	1958	4,133	100%
1926	2,178	1,733	1,956	47%	5%	1970	4,133	100%
1927	4,121	3,720	3,920	95%	6%	1982	4,133	100%
1928	2,016	1,805	1,910	46%	8%	1984	4,133	100%
1929	904	677	790	19%	9%	1967	4,105	99%
1930	2,179	1,991	2,085	50%	10%	1999	4,088	99%
1931	1,128	1,049	1,089	26%	11%	1974	3,926	95%
1932	1,438	1,222	1,330	32%	12%	1927	3,920	95%
1933	1,857	1,569	1,713	41%	14%	1998	3,908	95%
1934	1,352	1,351	1,352	33%	15%	1952	3,907	95%
1935	3,638	3,250	3,444	83%	16%	1978	3,904	94%
1936	3,566	3,101	3,334	81%	17%	1969	3,903	94%
1937	3,049	3,257	3,153	76%	19%	1983	3,903	94%
1938	4,133	4,133	4,133	100%	20%	1995	3,903	94%
1939	3,280	2,958	3,119	75%	21%	1941	3,859	93%
1940	3,731	3,178	3,454	84%	22%	1922	3,834	93%
1941	3,907	3,811	3,859	93%	24%	1996	3,807	92%
1942	3,981	3,531	3,756	91%	25%	1993	3,787	92%
1943	3,727	3,600	3,664	89%	26%	1980	3,769	91%
1944	2,521	1,955	2,238	54%	27%	1942	3,756	91%
1945	3,627	3,634	3,630	88%	28%	1973	3,665	89%
1946	3,463	3,104	3,283	79%	30%	1943	3,664	89%
1947	1,700	1,643	1,672	40%	31%	1945	3,630	88%
1948	3,037	2,726	2,881	70%	32%	2000	3,537	86%
1949	1,379	1,083	1,231	30%	33%	1940	3,454	84%
1950	2,771	2,120	2,446	59%	35%	1963	3,453	84%
1951	4,133	4,133	4,133	100%	36%	1935	3,444	83%
1952	3,907	3,906	3,907	95%	37%	1953	3,343	81%
1953	3,757	2,929	3,343	81%	38%	1971	3,337	81%
1954	3,025	2,989	3,007	73%	40%	1936	3,334	81%
1955	956	848	902	22%	41%	1989	3,324	80%
1956	4,133	4,133	4,133	100%	42%	1975	3,323	80%
1957	2,221	1,883	2,052	50%	43%	1946	3,283	79%
1958	4,133	4,133	4,133	100%	45%	1966	3,251	79%
1959	2,880	2,722	2,801	68%	46%	1997	3,250	79%
1960	1,705	1,370	1,537	37%	47%	1937	3,153	76%
1961	2,691	2,339	2,515	61%	48%	1965	3,135	76%
1962	2,963	3,126	3,044	74%	49%	1939	3,119	75%
1963	3,813	3,094	3,453	84%	51%	1979	3,049	74%
1964	1,572	1,907	1,739	42%	52%	1962	3,044	74%
1965	3,301	2,968	3,135	76%	53%	2003	3,030	73%

1 / See Table 6-3 2 / 4,133 taf/year

Table B-14 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability cure
Scenario: PCM Model with A2 emissions

Deliveries derived from Interpolating between "No Climate Change" and "PCM + A2 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1966	3,352	3,150	3,251	79%	54%	1954	3,007	73%
1967	4,133	4,077	4,105	99%	56%	1986	2,980	72%
1968	2,874	2,236	2,555	62%	57%	1948	2,881	70%
1969	3,903	3,903	3,903	94%	58%	1923	2,848	69%
1970	4,133	4,133	4,133	100%	59%	1985	2,836	69%
1971	3,566	3,108	3,337	81%	61%	1959	2,801	68%
1972	1,441	1,450	1,446	35%	62%	1968	2,555	62%
1973	3,959	3,371	3,665	89%	63%	1961	2,515	61%
1974	4,133	3,718	3,926	95%	64%	1981	2,515	61%
1975	3,521	3,124	3,323	80%	66%	1950	2,446	59%
1976	2,089	1,598	1,843	45%	67%	1987	2,320	56%
1977	281	264	273	7%	68%	1944	2,238	54%
1978	3,904	3,904	3,904	94%	69%	2002	2,137	52%
1979	3,182	2,915	3,049	74%	70%	1930	2,085	50%
1980	3,638	3,899	3,769	91%	72%	1957	2,052	50%
1981	2,659	2,370	2,515	61%	73%	1926	1,956	47%
1982	4,133	4,133	4,133	100%	74%	1928	1,910	46%
1983	3,903	3,903	3,903	94%	75%	1976	1,843	45%
1984	4,133	4,133	4,133	100%	77%	1994	1,776	43%
1985	2,926	2,746	2,836	69%	78%	1964	1,739	42%
1986	2,928	3,032	2,980	72%	79%	1933	1,713	41%
1987	2,627	2,014	2,320	56%	80%	1947	1,672	40%
1988	448	524	486	12%	82%	1960	1,537	37%
1989	3,457	3,191	3,324	80%	83%	1925	1,521	37%
1990	325	184	255	6%	84%	1972	1,446	35%
1991	883	683	783	19%	85%	1934	1,352	33%
1992	1,108	1,075	1,092	26%	87%	1932	1,330	32%
1993	4,046	3,527	3,787	92%	88%	1949	1,231	30%
1994	1,693	1,859	1,776	43%	89%	1992	1,092	26%
1995	3,903	3,903	3,903	94%	90%	1931	1,089	26%
1996	3,984	3,631	3,807	92%	91%	1955	902	22%
1997	3,254	3,246	3,250	79%	93%	2001	804	19%
1998	3,908	3,908	3,908	95%	94%	1929	790	19%
1999	4,052	4,123	4,088	99%	95%	1991	783	19%
2000	3,794	3,279	3,537	86%	96%	1988	486	12%
2001	795	812	804	19%	98%	1924	317	8%
2002	2,312	1,961	2,137	52%	99%	1977	273	7%
2003	3,226	2,834	3,030	73%	100%	1990	255	6%
Avg	2,870	2,668	2,769	67%			2,769	
Min	281	137	255	6%			255	
Max	4,133	4,133	4,133	100%			4,133	

1 / See Table 6-3 2/ 4,133 taf/year

Table B-15 SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability cure
Scenario: PCM Model with B1 emissions

Deliveries derived from Interpolating between "No Climate Change" and "PCM + B1 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1922	4,092	3,647	3,869	94%	0%	1938	4,133	100%
1923	3,091	3,033	3,062	74%	1%	1956	4,133	100%
1924	371	150	261	6%	3%	1958	4,133	100%
1925	1,718	1,669	1,693	41%	4%	1970	4,133	100%
1926	2,254	1,967	2,111	51%	5%	1982	4,133	100%
1927	4,086	3,680	3,883	94%	6%	1984	4,133	100%
1928	2,186	1,921	2,054	50%	8%	1999	4,118	100%
1929	945	729	837	20%	9%	1967	4,091	99%
1930	2,299	2,008	2,154	52%	10%	1951	4,046	98%
1931	1,130	1,090	1,110	27%	11%	1974	3,961	96%
1932	1,570	1,301	1,436	35%	12%	1998	3,908	95%
1933	2,340	1,944	2,142	52%	14%	1952	3,907	95%
1934	1,325	1,388	1,357	33%	15%	1978	3,905	94%
1935	3,779	3,126	3,452	84%	16%	1969	3,903	94%
1936	3,606	3,081	3,344	81%	17%	1983	3,903	94%
1937	3,337	3,593	3,465	84%	19%	1995	3,903	94%
1938	4,133	4,133	4,133	100%	20%	1942	3,886	94%
1939	3,414	3,035	3,224	78%	21%	1927	3,883	94%
1940	3,775	3,225	3,500	85%	22%	1941	3,873	94%
1941	3,907	3,839	3,873	94%	24%	1922	3,869	94%
1942	4,133	3,639	3,886	94%	25%	1996	3,823	92%
1943	3,772	3,503	3,637	88%	26%	1980	3,784	92%
1944	2,943	2,503	2,723	66%	27%	1993	3,732	90%
1945	3,556	3,467	3,511	85%	28%	1973	3,710	90%
1946	3,655	3,364	3,509	85%	30%	1943	3,637	88%
1947	1,752	1,860	1,806	44%	31%	2000	3,636	88%
1948	3,297	2,866	3,082	75%	32%	1953	3,516	85%
1949	1,467	1,245	1,356	33%	33%	1945	3,511	85%
1950	2,812	2,462	2,637	64%	35%	1946	3,509	85%
1951	4,133	3,958	4,046	98%	36%	1940	3,500	85%
1952	3,907	3,907	3,907	95%	37%	1937	3,465	84%
1953	3,922	3,110	3,516	85%	38%	1975	3,458	84%
1954	3,184	3,056	3,120	75%	40%	1935	3,452	84%
1955	1,024	1,024	1,024	25%	41%	1966	3,431	83%
1956	4,133	4,133	4,133	100%	42%	1971	3,397	82%
1957	2,443	1,976	2,210	53%	43%	1989	3,387	82%
1958	4,133	4,133	4,133	100%	45%	1936	3,344	81%
1959	3,199	2,946	3,073	74%	46%	1963	3,337	81%
1960	1,722	1,430	1,576	38%	47%	1997	3,291	80%
1961	2,650	2,408	2,529	61%	48%	1939	3,224	78%
1962	3,250	3,174	3,212	78%	49%	1962	3,212	78%
1963	3,640	3,034	3,337	81%	51%	1979	3,197	77%
1964	1,814	2,213	2,013	49%	52%	1985	3,163	77%
1965	3,348	2,884	3,116	75%	53%	1954	3,120	75%

1 / See Table 6-3 2/ 4,133 taf/year

Table B-15 (cont.) SWP Table A deliveries from the Delta under Future (2027) Conditions
Derived values for estimating probability cure
Scenario: PCM Model with B1 emissions

Deliveries derived from Interpolating between "No Climate Change" and "PCM + B1 Emissions"					Ranking of calculated Table A deliveries for probability curve			
Year	lower flow target[1] (taf)	higher flow target[1] (taf)	Average of flow targets (taf)	Percent of Maximum Table A[1]	Exceedence Frequency (%)	Year	Table A Delivery (taf)	Percent of Maximum Table A[2]
1966	3,486	3,376	3,431	83%	54%	1965	3,116	75%
1967	4,133	4,048	4,091	99%	56%	1948	3,082	75%
1968	2,990	2,363	2,676	65%	57%	1959	3,073	74%
1969	3,903	3,903	3,903	94%	58%	1923	3,062	74%
1970	4,133	4,133	4,133	100%	59%	2003	3,011	73%
1971	3,658	3,136	3,397	82%	61%	1986	2,805	68%
1972	1,489	1,495	1,492	36%	62%	1944	2,723	66%
1973	4,000	3,420	3,710	90%	63%	1968	2,676	65%
1974	4,133	3,789	3,961	96%	64%	1981	2,644	64%
1975	3,695	3,222	3,458	84%	66%	1950	2,637	64%
1976	2,227	1,631	1,929	47%	67%	1961	2,529	61%
1977	300	281	291	7%	68%	1987	2,465	60%
1978	3,905	3,905	3,905	94%	69%	2002	2,355	57%
1979	3,371	3,024	3,197	77%	70%	1957	2,210	53%
1980	3,687	3,881	3,784	92%	72%	1930	2,154	52%
1981	2,740	2,547	2,644	64%	73%	1933	2,142	52%
1982	4,133	4,133	4,133	100%	74%	1926	2,111	51%
1983	3,903	3,903	3,903	94%	75%	1994	2,066	50%
1984	4,133	4,133	4,133	100%	77%	1928	2,054	50%
1985	3,293	3,032	3,163	77%	78%	1964	2,013	49%
1986	2,799	2,810	2,805	68%	79%	1976	1,929	47%
1987	2,605	2,326	2,465	60%	80%	1947	1,806	44%
1988	483	454	468	11%	82%	1925	1,693	41%
1989	3,504	3,269	3,387	82%	83%	1960	1,576	38%
1990	367	311	339	8%	84%	1972	1,492	36%
1991	965	776	870	21%	85%	1932	1,436	35%
1992	1,243	1,124	1,183	29%	87%	1934	1,357	33%
1993	3,993	3,471	3,732	90%	88%	1949	1,356	33%
1994	1,874	2,258	2,066	50%	89%	1992	1,183	29%
1995	3,903	3,902	3,903	94%	90%	1931	1,110	27%
1996	4,021	3,624	3,823	92%	91%	1955	1,024	25%
1997	3,294	3,289	3,291	80%	93%	2001	949	23%
1998	3,908	3,908	3,908	95%	94%	1991	870	21%
1999	4,103	4,133	4,118	100%	95%	1929	837	20%
2000	3,913	3,359	3,636	88%	96%	1988	468	11%
2001	884	1,014	949	23%	98%	1990	339	8%
2002	2,595	2,115	2,355	57%	99%	1977	291	7%
2003	3,201	2,820	3,011	73%	100%	1924	261	6%
Avg	2,954	2,746	2,850	69%			2,850	
Min	300	150	261	6%			261	
Max	4,133	4,133	4,133	100%			4,133	

1 / See Table 6-3 2/ 4,133 taf/year

Table B-16 SWP Article 21 deliveries under Current (2007) Conditions

Year	Article 21 Demand (taf)	Article 21 Deliveries		
		Under less restrictive flow targets[1] (taf)	Under less restrictive flow targets[1] (taf)	Average of flow target scenarios (taf)
1922	1,408	0	0	0
1923	1,408	0	0	0
1924	1,408	0	0	0
1925	1,408	0	0	0
1926	1,408	0	0	0
1927	1,408	0	0	0
1928	1,408	0	0	0
1929	1,408	0	0	0
1930	1,408	0	0	0
1931	1,408	0	0	0
1932	1,408	0	0	0
1933	1,408	77	0	38
1934	1,408	0	0	0
1935	1,408	0	0	0
1936	1,408	0	0	0
1937	1,408	0	0	0
1938	1,408	589	586	587
1939	1,408	124	59	92
1940	1,408	0	0	0
1941	652	100	0	50
1942	1,408	672	324	498
1943	1,156	555	471	513
1944	1,408	0	0	0
1945	1,408	0	0	0
1946	1,408	0	0	0
1947	1,408	0	0	0
1948	1,408	0	0	0
1949	1,408	0	0	0
1950	1,408	0	0	0
1951	1,408	308	134	221
1952	652	100	100	100
1953	1,408	90	90	90
1954	1,156	0	0	0
1955	1,408	0	0	0
1956	1,408	319	194	256
1957	1,408	0	0	0
1958	1,408	563	154	359
1959	1,408	50	42	46
1960	1,408	0	0	0
1961	1,408	0	0	0
1962	1,408	0	0	0
1963	1,408	0	0	0
1964	1,408	0	0	0
1965	1,408	0	0	0

1/ See Table 6-3

Table B-16 (cont.) SWP Article 21 deliveries under Current (2007) Conditions

Year	Article 21 Demand (taf)	Article 21 Deliveries		
		Under less restrictive flow targets[1] (taf)	Under less restrictive flow targets[1] (taf)	Average of flow target scenarios (taf)
1966	1,408	0	0	0
1967	1,408	270	0	135
1968	1,408	165	0	82
1969	652	199	199	199
1970	1,408	552	368	460
1971	1,156	0	0	0
1972	1,408	0	0	0
1973	1,408	0	0	0
1974	1,408	96	0	48
1975	1,408	346	0	173
1976	1,408	10	0	5
1977	1,408	0	0	0
1978	652	200	0	100
1979	1,408	0	0	0
1980	400	189	188	189
1981	1,408	0	0	0
1982	1,156	527	453	490
1983	652	400	400	400
1984	1,408	552	368	460
1985	1,156	0	0	0
1986	652	53	0	27
1987	1,408	0	0	0
1988	1,156	0	0	0
1989	1,408	0	0	0
1990	1,408	0	0	0
1991	1,408	0	0	0
1992	1,408	0	0	0
1993	1,408	0	0	0
1994	1,408	0	0	0
1995	652	100	35	67
1996	1,408	423	387	405
1997	1,156	458	227	342
1998	652	178	100	139
1999	1,408	469	285	377
2000	1,156	0	0	0
2001	1,408	0	0	0
2002	1,408	0	0	0
2003	1,408	0	0	0
Avg	1,297	106	63	85
Min	400	0	0	0
Max	1,408	672	586	587

1/ See Table 6-3

Table B-17 SWP Article 21 deliveries under Future (2027) Conditions for climate change scenario GFDL with A2 emissions

Year	Article 21 Demand (taf)	Article 21 Deliveries Under less restrictive flow targets[1]			Article 21 Deliveries Under more restrictive flow targets[1]			Averaged Article 21 Deliveries GFDL-A2 (taf)
		No Climate Change (taf)	GFDL with A2 emissions (taf)	Interpolated GFDL-A2[2] (taf)	No Climate Change (taf)	GFDL with A2 emissions (taf)	Interpolated GFDL-A2[2] (taf)	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	5	6	22	116	66	36
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	125	58	0	66	31	44
1933	1,408	87	0	47	0	0	0	23
1934	1,408	0	0	0	0	17	8	4
1935	1,408	0	273	127	0	121	56	92
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	22	10	0	0	0	5
1938	1,408	165	333	243	0	334	155	199
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	0	9	0	0	0	4
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	264	214	115	115	115	164
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	466	397	172	268	217	307
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	0	56	0	0	0	28
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	203	94	0	0	0	47

1/ See Table 6-3 2/ As described in Appendix B

February 25, 2008

Supplemental Information Related to the Summary of Updated State Water Project Water Supply Conditions

Introduction

This memorandum provides supplementary information provided by Castaic Lake Water Agency (CLWA) intended to augment that provided in the February 22, 2008 memorandum previously prepared. The February 22, 2008 memorandum provided a summary of the updated water supply conditions relative to CLWA's State Water Project (SWP) supplies as described in CLWA's 2005 Urban Water Management Plan (2005 UWMP). The updated conditions included therein focused on the information provided in CLWA's February 5, 2008 letter to the Los Angeles County Department of Regional Planning which was included as Attachment A to that memorandum, as well as additional updated information provided by CLWA. The aforementioned letter and information provided an update of the water supply conditions resulting from the release of the Draft SWP Delivery Reliability Report 2007 (DWR 2007).

The purpose of this memorandum is to provide additional detail related to the updated SWP water supply conditions, i.e., to provide the supplementary information provided by CLWA subsequent to the February 22, 2008 memorandum. Please refer to the February 22, 2008 memorandum for additional background information on the 2005 UWMP and the Draft SWP Delivery Reliability Report 2007.

Updated Water Supply Conditions

Draft State Water Project Delivery Reliability Report 2007

The Draft SWP Delivery Reliability Report 2007 includes the information presented in Tables 1 and 2 below and is relevant to the additional information provided by CLWA presented in the following section of this memorandum. The tables provide average and dry period deliveries for current conditions (2007) and future conditions (2027) as described in the Draft SWP Delivery Reliability Report 2007, and provide a comparison to the 2005 SWP Reliability Report.

TABLE 1
Average and Dry Period SWP Table A Deliveries from the Delta under Current Conditions

	SWP Table A Delivery from the Delta (in percent of maximum Table A[1])					
Study of Current Conditions	**Long-term Average[2]**	**Single dry-year (1977)**	**2-year drought (1976-1977)**	**4-year drought (1931-1934)**	**6-year drought (1987-1992)**	**6-year drought (1929-1934)**
2005 SWP Reliability Report, Study 2005	68%	4%	41%	32%	42%	37%
Update with 2007 Studies[3]	63%	6%	34%	35%	35%	34%

Source: DWR 2007; Table 6-5.
Notes:
(1) Maximum Table A Amount is 4,133 taf/year.
(2) 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2007 studies.
(3) Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6-3 of the Draft SWP Delivery Reliability Report 2007.

TABLE 2
Average and Dry Period SWP Table A Deliveries from the Delta under Future Conditions

	SWP Table A Delivery from the Delta (in percent of maximum Table A[1])					
Study of Future Conditions	**Long-term Average[2]**	**Single dry-year (1977)**	**2-year drought (1976-1977)**	**4-year drought (1931-1934)**	**6-year drought (1987-1992)**	**6-year drought (1929-1934)**
2005 SWP Reliability Report, Study 2025	77%	5%	40%	33%	42%	38%
Update with 2027 Studies[3]	66-69%	7%	26-27%	32-37%	33-35%	33-36%

Source: DWR 2007; Table 6-14.
Notes:
(1) Maximum Table A Amount is 4,133 taf/year.
(2) 1922-1994 for 2005 SWP Delivery Reliability Report; 1922-2003 for Update with 2027 studies.
(3) Range in values reflects four modified scenarios of climate change: annual Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Draft State Water Project Delivery Reliability Report 2007 Applied to CLWA SWP Supplies

The supplemental information provided by CLWA that further describes the assumed updates to the information provided in the 2005 UWMP based upon the Draft SWP Delivery Reliability Report 2007 is presented in Table 3 through Table 6 below. Table 3 provides an update of the summary of current and planned water supplies and banking programs as described in the 2005 UWMP through the year 2030. Tables 4 through 6 provide updated tables from those in the 2005 UWMP showing the updated supplies in five-year increments for average, single-dry and multi-dry years. The information presented is based upon the information in the Draft SWP Delivery Reliability Report 2007 (as shown in Table 1 and

Table 2 above) and includes interpolating for the five-year intervals. In addition, as described in the February 22, 2008 memorandum, CLWA has included certain updated information regarding other sources of supply. The updated supply figures affecting the water supply totals are shown in the highlighted cells in the table. It should be noted that the SWP Table A amounts shown in the table below are rounded.

Table 3
Summary of Current and Planned Water Supplies and Banking Programs(1)

Water Supply Sources	Supply (af)					
	2007	**2010**	**2015**	**2020**	**2025**	**2030**
Existing Supplies (1)						
Wholesale (Imported)	*64,680*	*78,667*	*79,667*	*79,287*	*80,287*	*80,287*
SWP Table A Supply (2)	60,000	60,000	61,000	62,000	63,000	63,000
Buena Vista-Rosedale	0	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Ranch	0	1,607	1,607	1,607	1,607	1,607
Flexible Storage Account (CLWA) (3)	4,680	4,680	4,680	4,680	4,680	4,680
Flexible Storage Account (Ventura County) (3) (4)	0	1,380	1,380	0	0	0
Local Supplies						
Groundwater	*40,000*	*46,000*	*46,000*	*46,000*	*46,000*	*46,000*
Alluvial Aquifer	35,000	35,000	35,000	35,000	35,000	35,000
Saugus Formation	5,000	11,000	11,000	11,000	11,000	11,000
Recycled Water	1,700	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	106,380	126,367	127,367	126,987	127,987	127,987
Existing Banking Programs (3)						
Semitropic Water Bank (5)	50,870	50,870	0	0	0	0
Rosedale-Rio Bravo (7)	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic Water Bank - Newhall Ranch	0	0	0	0	0	0
Total Existing Banking Programs	70,870	70,870	20,000	20,000	20,000	20,000
Planned Supplies (1)						
Local Supplies						
Groundwater	*0*	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*
Restored wells (Saugus Formation)	0	10,000	10,000	10,000	10,000	10,000
New Wells (Saugus Formation)	0	0	0	10,000	10,000	10,000
Recycled Water - CLWA (6)	0	0	1,600	6,300	11,000	15,700
Recycled Water - Newhall Ranch	0	0	1,500	2,500	3,500	5,400
Total Planned Supplies	0	10,000	13,100	28,800	34,500	41,100
Planned Banking Programs (3)						
Additional Planned Banking	0	0	20,000	20,000	20,000	20,000
Total Planned Banking Programs	0	0	20,000	20,000	20,000	20,000

Table 3

Summary of Current and Planned Water Supplies and Banking Programs[1]

Water Supply Sources	Supply (af)					
	2007	2010	2015	2020	2025	2030

Source: J. Ford, CLWA 2008; CLWA 2005, Table 3-1.

Notes:

(1) The values shown under "Existing Supplies" and "Planned Supplies" are supplies projected to be available in average/normal years. The values shown under "Existing Banking Programs" and "Planned Banking Programs" are either total amounts currently in storage, or the maximum capacity of program withdrawals.

(2) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available, based on Tables 6-5 and 6-14 of DWR's "Draft State Water Project Delivery Reliability Report 2007".

(3) Supplies shown are total amounts that can be withdrawn, and would typically be used only during dry years.

(4) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(5) Supplies shown are the total amount currently in storage, and would typically be used only during dry years. Once the current storage amount is withdrawn, this supply would no longer be available and in any event, is not available after 2013.

(6) Recycled water supplies based on projections provided in CLWA's 2005 UWMP Chapter 4, Recycled Water.

(7) CLWA has banked 64,900 af as of 12/31/07 in the Rosedale-Rio Bravo Water Banking and Recovery Program.

Table 4

Projected Average/Normal Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*73,007*	*73,707*	*74,407*	*75,107*	*75,407*
SWP Table A Supply (1)	60,400	61,100	61,800	62,500	62,800
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Ranch	1,607	1,607	1,607	1,607	1,607
Flexible Storage Account (CLWA) (2)	0	0	0	0	0
Flexible Storage Account (Ventura County) (2)	0	0	0	0	0
Local Supplies					
Groundwater	*46,000*	*46,000*	*46,000*	*46,000*	*46,000*
Alluvial Aquifer	35,000	35,000	35,000	35,000	35,000
Saugus Formation	11,000	11,000	11,000	11,000	11,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	120,707	121,407	122,107	122,807	123,107
Existing Banking Programs					
Semitropic Water Bank (2)	0	0	0	0	0
Rosedale-Rio Bravo (2)	0	0	0	0	0
Semitropic Water Bank - Newhall Ranch	0	0	0	0	0
Total Existing Banking Programs	0	0	0	0	0

Table 4

Projected Average/Normal Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Planned Supplies					
Local Supplies					
Groundwater	*0*	*0*	*0*	*0*	*0*
Restored wells (Saugus Formation) (2)	0	0	0	0	0
New Wells (Saugus Formation) (2)	0	0	0	0	0
Recycled Water - CLWA (3)	0	1,600	6,300	11,000	15,700
Recycled Water - Newhall Ranch	0	1,500	2,500	3,500	5,400
Total Planned Supplies	0	3,100	8,800	14,500	21,100
Planned Banking Programs					
Additional Planned Banking (2)	0	0	0	0	0
Total Planned Banking Programs	0	0	0	0	0
Total Existing and Planned Supplies and Banking	120,707	124,507	130,907	137,307	144,207
Total Estimated Demand (w/o conservation) (4)	100,050	109,400	117,150	128,400	138,300
Conservation (5)	(8,600)	(9,700)	(10,700)	(11,900)	(12,900)
Total Adjusted Demand	91,450	99,700	106,450	116,500	125,400

Source: J. Ford, CLWA 2008; CLWA 2005, Table 6-2.

Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available on Tables 6-5 and 6-14 of DWR's "Draft State Water Project Delivery Reliability Report 2007".

(2) Not needed during average/normal years.

(3) Recycled water supplies based on projections provided in CLWA's 2005 UWMP Chapter 4, Recycled Water.

(4) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area are not included.

(5) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in CLWA's 2005 UWMP, Chapter 7.

Table 5
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	**Supply (af)**				
	2010	**2015**	**2020**	**2025**	**2030**
Existing Supplies					
Wholesale (Imported)	*24,567*	*24,767*	*23,587*	*23,887*	*23,987*
SWP Table A Supply (1)	5,900	6,100	6,300	6,600	6,700
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Ranch	1,607	1,607	1,607	1,607	1,607
Flexible Storage Account (CLWA)	4,680	4,680	4,680	4,680	4,680
Flexible Storage Account (Ventura County)(2)	1,380	1,380	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	73,767	73,967	72,787	73,087	73,187
Existing Banking Programs					
Semitropic Water Bank (3)	17,000	0	0	0	0
Rosedale-Rio Bravo (5)	20,000	20,000	20,000	20,000	20,000
Semitropic Water Bank - Newhall Ranch	0	0	0	0	0
Total Existing Banking Programs	37,000	20,000	20,000	20,000	20,000
Planned Supplies					
Local Supplies					
Groundwater	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*
Restored wells (Saugus Formation)	10,000	10,000	10,000	10,000	10,000
New Wells (Saugus Formation)	0	0	10,000	10,000	10,000
Recycled Water - CLWA (4)	0	1,600	6,300	11,000	15,700
Recycled Water - Newhall Ranch	0	1,500	2,500	3,500	5,400
Total Planned Supplies	10,000	13,100	28,800	34,500	41,100
Planned Banking Programs					
Additional Planned Banking (6)	0	20,000	20,000	20,000	20,000
Total Planned Banking Programs	0	20,000	20,000	20,000	20,000
Total Existing and Planned Supplies and Banking	120,767	127,067	141,587	147,587	154,287
Total Estimated Demand (w/o conservation) (7) (8)	110,100	120,300	128,900	141,200	152,100
Conservation (9)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Table 5
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030

Source: J. Ford, CLWA 2008; CLWA 2005, Table 6-3.
Notes:
(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of single dry year deliveries projected to be available on Tables 6-5 and 6-14 of DWR's "Draft State Water Project Delivery Reliability Report 2007".
(2) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).
(3) The total amount of water currently in storage is 50,870 af, available through 2013. Withdrawals of up to this amount are potentially available in a dry year, but given possible competition for withdrawal capacity with other Semitropic banking partners in extremely dry years, it is assumed here that about one third of the total amount stored could be withdrawn.
(4) Recycled water supplies based on projections provided in CLWA's 2005 UWMP Chapter 4, Recycled Water.
(5) CLWA has banked 64,900 af as of 12/31/07 in the Rosedale-Rio Bravo Water Banking and Recovery Program.
(6) Assumes additional planned banking supplies available by 2014.
(7) Assumes increase in total demand of 10 percent during dry years.
(8) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area are not included.
(9) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in CLWA's 2005 UWMP, Chapter 7.

Table 6
Projected Multiple-Dry Year Supplies and Demands(1)

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*47,017*	*46,317*	*45,277*	*44,477*	*44,277*
SWP Table A Supply (2)	32,900	32,200	31,500	30,700	30,500
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Ranch	1,607	1,607	1,607	1,607	1,607
Flexible Storage Account (CLWA) (3)	1,170	1,170	1,170	1,170	1,170
Flexible Storage Account (Ventura County) (3)	340	340	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation (4)	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	96,217	95,517	94,477	93,677	93,477
Existing Banking Programs					
Semitropic Water Bank (3)	12,700	0	0	0	0
Rosedale-Rio Bravo (6) (7)	5,000	15,000	15,000	15,000	15,000
Semitropic Water Bank - Newhall Ranch	0	0	0	0	0
Total Existing Banking Programs	17,700	15,000	15,000	15,000	15,000
Planned Supplies					
Local Supplies					
Groundwater	*6,500*	*6,500*	*6,500*	*6,500*	*6,500*

Table 6

Projected Multiple-Dry Year Supplies and Demands[1]

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Restored wells (Saugus Formation) (4)	6,500	6,500	5,000	5,000	5,000
New Wells (Saugus Formation) (4)	0	0	1,500	1,500	1,500
Recycled Water (5)	0	1,600	6,300	11,000	15,700
Recycled Water - Newhall Ranch	0	1,500	2,500	3,500	5,400
Total Planned Supplies	6,500	9,600	15,300	21,000	27,600
Planned Banking Programs					
Additional Planned Banking (7) (8)	0	5,000	15,000	15,000	15,000
Total Planned Banking Programs	0	5,000	15,000	15,000	15,000
Total Existing and Planned Supplies and Banking	120,417	125,117	139,777	144,677	151,077
Total Estimated Demand (w/o conservation) (9) (10)	110,100	120,300	128,900	141,200	152,100
Conservation (11)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Source: J. Ford, CLWA 2008; CLWA 2005, Table 6-4.

Notes:

(1) Supplies shown are annual averages over four consecutive dry years (unless otherwise noted).

(2) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available during the worst case four-year drought of 1931-1934 as provided in Tables 6-5 and 6-14 of DWR's "Draft State Water Project Delivery Reliability Report 2007."

(3) Based on total amount of storage available divided by 4 (4-year dry period). Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(4) Total Saugus pumping is the average annual amount that would be pumped under the groundwater operating plan, as summarized in Table 3-6 ([11,000+15,000+25,000+35,000]/4).

(5) Recycled water supplies based on projections provided in CLWA's 2005 UWMP Chapter 4, Recycled Water.

(6) CLWA has banked 64,900 af as of 12/31/07 in the Rosedale-Rio Bravo Water Banking and Recovery Program.

(7) Average dry year period supplies could be up to 20,000 af for each program depending on storage amounts at the beginning of the dry period.

(8) Assumes additional planned banking supplies available by 2014.

(9) Assumes increase in total demand of 10 percent during dry years.

(10) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area are not included.

(11) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in CLWA's 2005 UWMP, Chapter 7.

The above discussion provides additional detail as it relates to the conclusion provided in the February 5, 2008 letter provided by CLWA to the Los Angeles County Department of Regional Planning in which CLWA has determined that, while the injunction is in effect, there are sufficient water supplies available for pending and future residential and commercial developments within the CLWA service area for the foreseeable future through 2030 as set forth in the 2005 UWMP.

References:

CLWA (Castaic Lake Water Agency). 2005. 2005 Urban Water Management Plan. Prepared for the Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District, Valencia Water Company. November.

DWR (Department of Water Resources). 2007. Draft State Water Project Delivery Reliability Report 2007. December.

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